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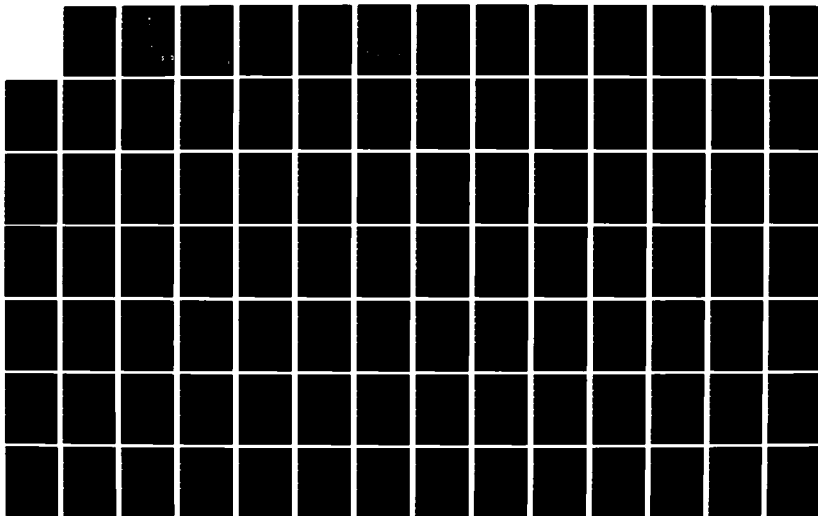
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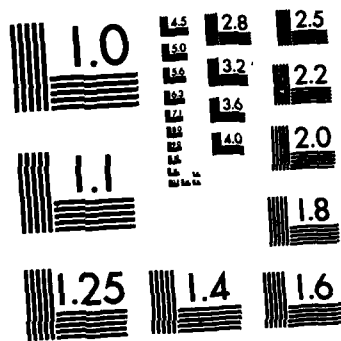
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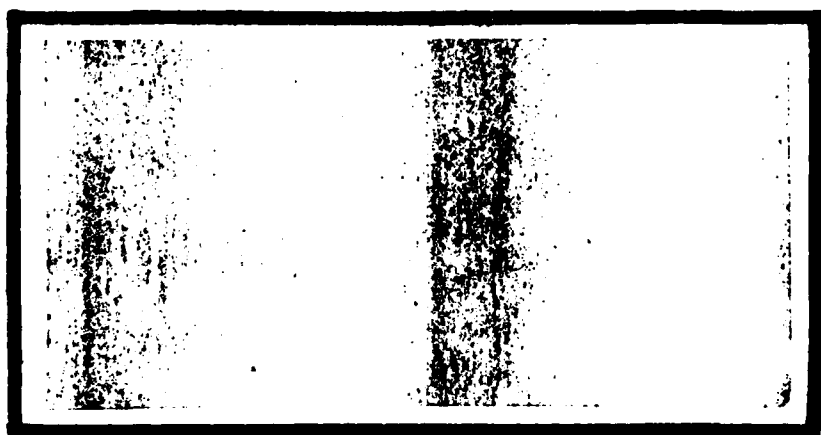
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A METHODOLOGY FOR CONUS APOE
RECEPTION PLANNING

Larry E. Fortner
First Lieutenant, USAF

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→ In a wartime contingency, several AFLC bases would be tasked to serve as aerial ports of embarkation for large quantities of personnel and equipment. The managers must develop reception plans to deal with that potential workload, but lack the necessary information on its size. Furthermore, they have no method of testing their plans once developed. This thesis develops two computer simulation models to solve these problems. The first draws input from existing TPFDD data and translates it into a 'rough cut' estimate of the workload based on an unconstrained flow through the system. Based on this workload, the managers can develop a plan. The second model allows the managers to define resource levels, activity times, and policy options to reflect their plan. By running the TPFDD data through this second model, they can test their plan prior to execution. The models are demonstrated using a randomly-generated data base in standard TPFDD format and a hypothetical reception plan. This demonstration shows the power of simulation in solving these problems, and proves that the methodology mapped out is a workable solution. Extensive recommendations are given for further refinement of and experimentation with the models.

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A METHODOLOGY FOR CONUS APOE
RECEPTION PLANNING

A Thesis

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology

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In Partial Fulfillment of the Requirement for the
Degree of Master of Science in Logistics Management

By

Larry E. Fortner, BS
First Lieutenant, USAF

September 1982

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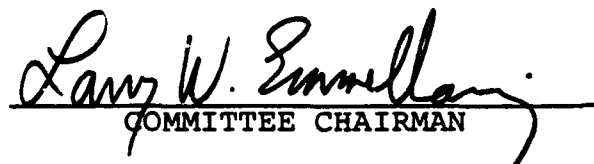
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of the School of Systems and Logistics in partial fulfillment
of the requirements for the degree of

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CHAPTER 1

INTRODUCTION

Under wartime contingencies, the Air Logistics Centers (ALCs) managed by the Air Force Logistics Command (AFLC) are responsible for many actions not a part of their normal day-to-day business. Some ALCs are tasked as Aerial Ports of Embarkation (APOEs). Certain ALCs (Oklahoma City, Ogden, and San Antonio), along with Wright-Patterson AFB, are also tasked to serve as aerial ports for resupply. In these capacities, they must be prepared not only to mobilize and deploy units permanently stationed on that base, but also to receive and deploy units of all services mobilized elsewhere in their geographic area, and to handle the large volume of unit-related and nonunit-related cargo which will be moved in conjunction with any such deployment (3; 9; 24).

BACKGROUND

The mobilization and deployment process can be depicted as a flow of units and cargo through several sequential and/or parallel processes (Figure 1). These four processes include the:

- (1) on-base mobility process
- (2) off-base mobilization/mobility process
- (3) reception activities
- (4) aerial port activities

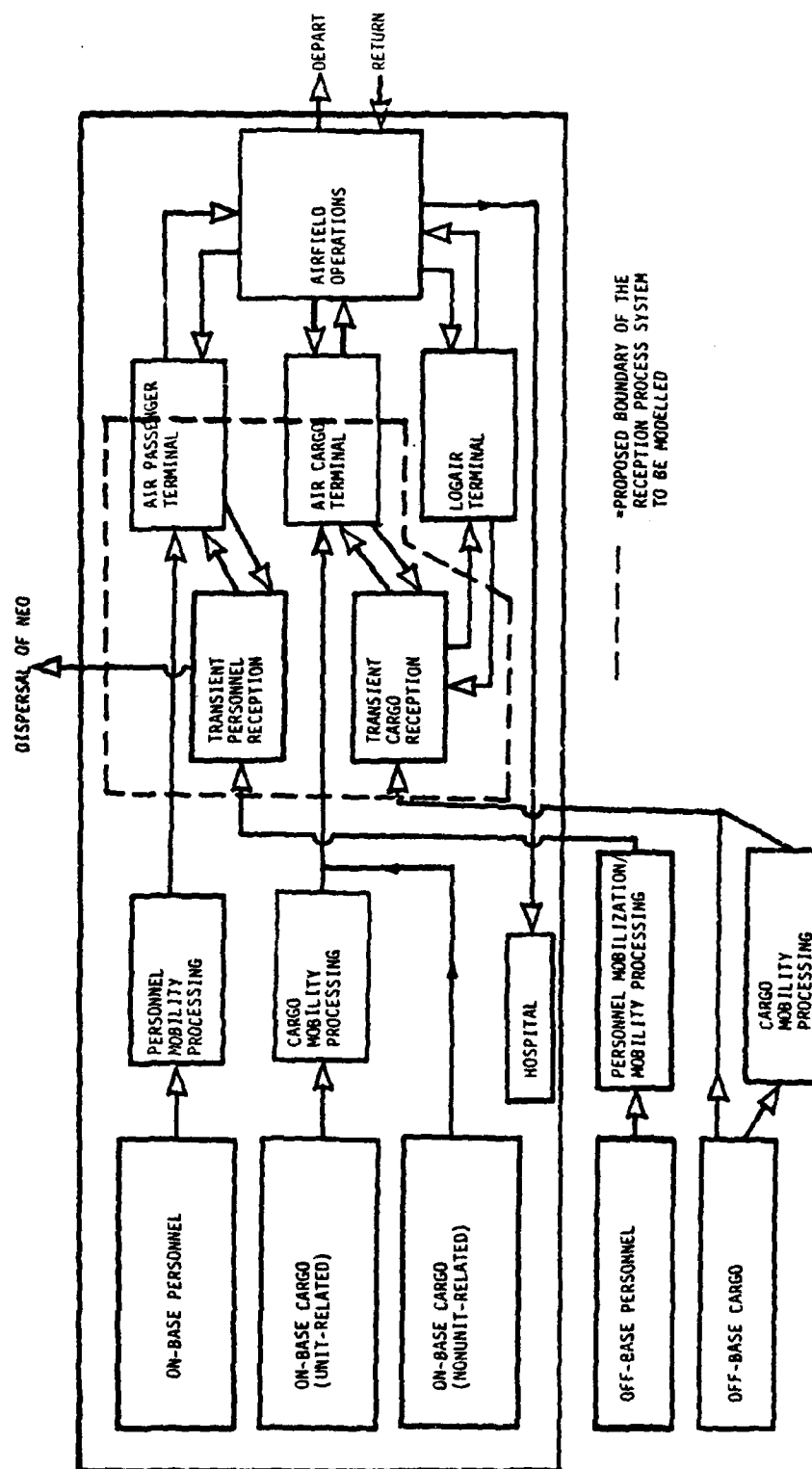


Figure 1: A Generalized APOB Flow Schematic

As depicted in the diagram, both the people and the cargo arrive at the aerial port, but by different paths.

The reception process is not well defined for CONUS bases. One definition of the reception process includes only providing food, shelter, and other necessities to units and individuals arriving from off-base; and receiving, sorting, and preparing off-base unit-related cargo for loading. Activities related to on-base units; unit- and nonunit-related cargo; and any part of the Air Cargo Terminal are specifically excluded (11). AFR 28-4, USAF Mobility Planning, describes the contents of base reception plans (Para. 1-1c, shown in Appendix A). However, the wording is more appropriate for destination bases than for APOEs. The regulation as a whole fails to address the unique requirements faced by a CONUS APOE which serves off-base units. This regulation is currently being revised to include these requirements. In anticipation of the revision to AFR 28-4, this thesis will use the current edition's framework for defining the reception process, which will be discussed in the following sections.

As of May 1982, all AFLC-managed APOEs had been tasked to publish a reception plan. Due to short manning and higher priority taskings, however, the work had not yet been completed (8; 12; 24). Therefore, the following discussion is based on interviews with experts in this area,

rather than on published plans.

PROCESS DESCRIPTION

Units permanently assigned to the APOE base enter the on-base mobility process to insure that they are ready to deploy. This involves updating shot records, wills, and other paperwork and checking personal equipment for completeness. These on-base units then remain in the passenger staging area until a certain time prior to their departure, when they are transported to the Air Passenger Terminal (4; 11; 12; 24).

Equipment (or cargo) located on-base undergoes a parallel process. There are two classes of cargo: unit-related, which is identified as the equipment or accompanying supplies of a specific unit; and nonunit-related, which is anything not identified to a specific unit (18:p.X). The unit-related cargo is put through cargo mobility processing by the possessing unit and then is moved to the marshalling area. The bulk of the on-base nonunit-related cargo comes from the ALC warehousing system or the ALC maintenance facilities. This cargo does not go through the mobility processing. Instead, it is packed for shipment by activities within the Directorate of Distribution or by a Combat Logistic Support Squadron group and delivered directly to the Air Cargo Terminal where it is sorted into aircraft loads and held until departure (4; 11; 12; 13; 24).

Following mobilization, which brings the reserve forces to active duty, the off-base units and their equipment undergo mobility processing at their home station. They then generally remain at that location until the appropriate time for them to report to the APOE. In the same manner, nonunit-related personnel are processed, and report to the APOE at the appropriate time. Nonunit-related cargo may arrive by commercial transport (truck or rail), or by LOGAIR. This cargo may or may not be received in an airlift-ready condition. Upon arrival, these units, individuals, and cargo enter the reception process (12; 13; 24).

The first step in the reception process is an inspection and validation of the mobility processing step. This inspection is designed to detect errors or omissions in earlier processing. These mistakes are referred to the appropriate activity for corrective action. The decisions as to where the people or cargo should be sent within the reception process are also made at this point (4; 12; 24).

In addition to this initial inspection, the managers of the reception process are responsible for providing food and shelter as needed by these units and individuals while they are at the APOE. The managers are also responsible for medical care, on-base transportation, and administrative activities associated with the movement of these units and the nonunit-related personnel, as well as the

temporary storage, final processing, and marshalling of the unit- and nonunit-related cargo. Not all of the off-base units will be deploying. Certain units will be assigned to the APOE to assume roles formerly filled by the on-base units already deployed. These units may or may not deploy at a later date. There will also be an influx of mobilization augmentees who will report to the ALC. Therefore, the reception process will have to provide both transient facilities (for the deploying units) and "permanent" facilities (for the replacement units and mobilization augmentees) (3; 4; 9; 12; 13; 24).

At the appropriate time, the reception process delivers the passengers and cargo to the aerial port process, where they are loaded onto military or Civil Reserve Air Fleet (CRAF) aircraft and flown to their Aerial Port of Debarkation (APOD). Once the aircraft has departed, its passengers and cargo are out of the APOE system. However, aircraft will be returning from the destination(s) carrying an unknown number of dependents, US civilians, wounded personnel, and broken or damaged equipment which will provide additional input to the APOE system. These will enter the aerial port process, and subsequently the reception process, essentially moving backwards through the system (4; 12; 24).

This definition of the reception process requires that virtually all personnel and cargo moving into or out of the aerial port process pass through the reception process,

as shown in Figure 1. It is because of this rather comprehensive definition of the reception process that the on-base units are said to enter it following mobility processing. This is not readily apparent, since these units presumably would not go through mobility processing until immediately prior to deployment, and therefore would not require feeding or housing from the reception process. However, they still require transportation to the flightline, inflight meals, etc.; and, depending on the circumstances, might remain at the APOE for quite some time following processing. As was mentioned earlier, all such activities are included in this definition of the reception process so as to account for all demands to be placed against the APOE's resources.

These reception activities will place demands against the limited resources over and above the normal base workload. The specific demand levels will be determined by the arrival and departure times of the transient units and non-unit-related personnel; the arrival schedule for the non-deploying replacement units; and the quantity of personnel and materiel in each category. This information is available from several sources. The Joint Operations Planning System (JOPS) publishes the overall schedule of when each unit involved in a wartime scenario will be at certain stages in the deployment process. This includes the Ready to Load Date (RLD) at the home base, the Available to Load Date (ALD) at the Aerial Port of Embarkation, the Earliest

and Latest Arrival Dates (EAD and LAD) at the Aerial Port of Debarkation, and the Required Delivery Date (RDD) at the final destination. The Military Traffic Management Command (MTMC) has the responsibility for scheduling the movement of the off-base units to the APOE by rail, bus, air, or other commercial means. These times, once established, are published on MTMC's movement tables. The Military Airlift Command (MAC) uses the JOPS data to generate movement tables for the airlift to the Aerial Port of Debarkation, and publishes the times of pickup at the APOEs on their own movement tables. The Joint Deployment System (JDS), prepared and maintained by the Joint Deployment Agency (JDA), pulls all this information together in its JDS data base. This is available to all agencies with a WWMCCS Intercomputer Network (WIN) capability (2; 9; 12; 13; 24).

PROBLEM STATEMENT

APOE managers are charged with planning for and managing an extremely large, complex, and dynamic system, while lacking the needed information about the demands to be placed against that system or how the system will react to those demands. The managers do not have ready access to the movement tables generated by MAC and MTMC, nor does AFLC currently have full-scale WIN capability. Even with this information it would be exceedingly difficult for them to manually determine the impact of the schedules on their

limited resources. Due to the unpredictability of future events, the preplanned movement schedules can only be used as a rough indication of the expected flow of units. Because the National Command Authorities must (and will) respond to situations as they develop, the APOE managers are forced to plan for highly uncertain demand levels. While they know the estimated total numbers scheduled through their APOE, without the timing of that flow they cannot know the level of demands to be placed against their resources. Without the demand levels, they cannot confidently allocate their resources. Should they overestimate demands, resources will be wasted; if they underestimate, problems ranging from inconveniences to delayed departures will result. Either way, the overall war effort will suffer (3; 4; 9; 12; 13; 24).

OBJECTIVE AND RESEARCH STATEMENTS

The objective of this thesis is to provide the APOE managers with a means to produce from existing data the information that they must have to effectively plan for and control a mobilization/deployment activity; and to provide them with a means to test their plan. Two simulation models of this activity will be developed to determine the expected demands and the adequacy of a chosen APOE's resources to meet them. The following research statements will be the basis for this research:

- (1) Given an APOE with no existing reception plan

(or one with only loose guidelines), determine the demands against its resources for which it must develop a plan.

(2) Given an APOE with a well-defined reception plan, determine whether that plan can accommodate the demands projected to be placed against it by the various war plans if they are executed.

The first research statement reflects the current status of the majority of the Air Logistics Centers, along with Wright-Patterson AFB (8). All are developing reception plans, but are stymied by the lack of information on the demand levels for which they should be preparing. Once this information is available, a plan can be developed. The second statement proposes that the plan be tested to insure that it can accommodate any of the war plans. A third statement, which cannot be addressed in peacetime is: given an APOE with a well-defined reception plan and a war plan being executed, determine whether the reception plan can accommodate the actual demands to be placed against it.

This third statement reflects the ultimate use of the reception plan, and the ultimate use of this methodology. Given the information provided by the model in the execution mode, the managers can then act to prevent or minimize bottlenecks or delays by increasing their resource levels, or by slowing the arrival rates of off-base units. Even though this program may provide only several hours of warning

during an actual deployment, this is still considerably more than would be available without the model.

SCOPE

As introduced in the research statements, the models will function in three phases. In Phase I, the reception plan is loosely defined and resources are considered to be unlimited. This will produce a rough estimate of the flow of cargo and personnel, which can be used to define the levels of resources to be allocated to the reception process. Phase I should only be needed once during the development of the reception plan. The Phase II model will function as a test of the plan, with defined levels of resources allocated and a considerable increase in the detail of the model. Both phases will use input data derived from published plans on the JDS data base, with reasonable estimations of parameters which are not available. Phase III will only be used in an actual execution of one of the war plans, and again will pull input from the JDS data base. In this case, the model will run a five-day forecast of the workload based on the actual movement schedules prepared by the transportation operating agencies (MAC and MTMC). Other than describing the needed modifications to the computer input of the Phase II model, Phase III will not be addressed in any depth in this thesis.

In order that the project be kept to a manageable

size, the focus of the model will be on the reception process (as previously defined) and its resource allocation. The aerial port is considered to be outside of the reception process, although the passenger and cargo terminals will be included in the model. This will allow the managers to track the flow of people and cargo from entry to exit, and help them see how their complete system functions.

To further narrow the scope of the project, I have chosen to focus on the workload scheduled for Wright-Patterson AFB. Although the exact quantities and timings differ from base to base, the tasking presented to Wright-Patterson's reception process is similar in structure to that presented to the other APOEs (12). Therefore, the basic structure of the model should be applicable to any APOE.

CHAPTER SUMMARY

This chapter has presented the problem faced by APOE managers in planning for the workload which will be imposed by any mobilization/deployment activity. The reception process, which is the center of activity in those operations for the APOE, was explained. A comprehensive definition was given for the reception process and was justified by the need to fully account for all demands to be placed by all units and equipment flowing into and out of the APOE. The problem statement and research statements to be addressed were given, and the scope of the thesis was explained.

Chapter 2 will provide a more detailed conceptualization of the reception process and associated activities. Subsequent chapters will address the computerization of the model and the implementation of the methodology.

CHAPTER 2

CONCEPTUALIZATION

This chapter will explain in detail the reception process and the three phases of the model which will replicate it. The initial discussion will use a systems approach to explain the workings of the process. The flow of personnel and cargo through the system will then be described in detail. Once the process is fully described, the three phases of the model to be used to study the system will be developed. This procedure corresponds to the logical order used by the planners in developing the individual reception plans.

A SYSTEMS SCIENCE OVERVIEW

Systems science represents a departure from the analytical school of thought which dominated thinking prior to the Second World War. The analytical method involves examining an entity by breaking it into its component parts and scrutinizing each part by itself (analyzing), and putting the knowledge thus gained together (synthesizing) in hope of understanding the whole (16:6-7). Systems theory contends that this approach totally disregards goal-directedness, and is incapable of describing complex systems since it is unable to account for interrelationships between components. Systems science concentrates on the processes that

link the components together. This is not to say that systems science contradicts the analytical approach. The two methods supplement each other in the study of a system, since one must understand both the components and their interrelationships to fully understand the system (16:7-8).

The simplest system can be represented as in Figure 2 below. This is the input-process-output model, in which the system accepts inputs from either within its boundaries (as in the case of the closed system) or from its environment (i.e., the open system). The system then processes the inputs, converting them into outputs.

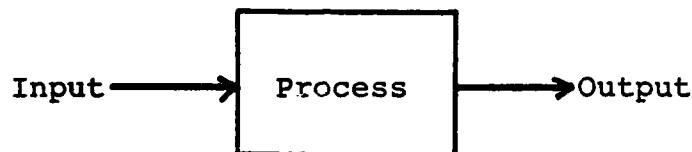


Figure 2: Basic System

Two significant characteristics of systems are serialized input and nesting. Serialized (or inline) input is shown in Figure 3, which represents the output of one system as the input to another.

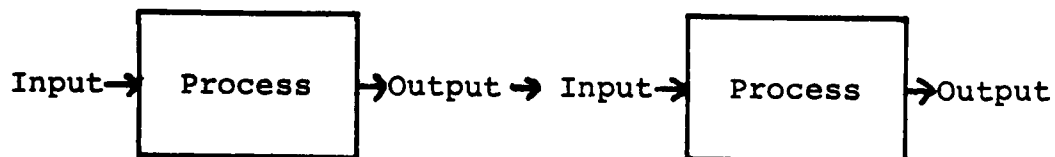


Figure 3: Serialized Systems

Nesting of systems (Figure 4) shows that what in one sense might be called a system can, in another sense, be considered a subsystem of a larger system, which is itself a subsystem of yet another even larger system.

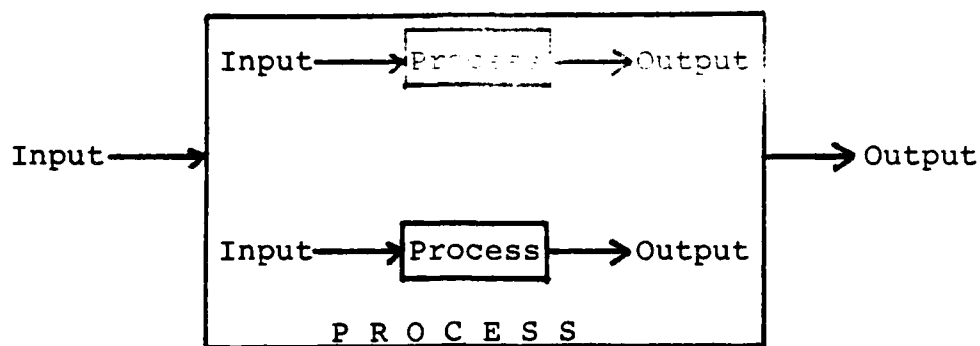


Figure 4: Nested Systems

Another consideration in systems thinking is the need for defining the level of resolution to be used. Examining too broad a system will cause the researcher to lose a certain level of detail. For instance, it is difficult to study the workings of a cell when the system being examined is a forest. On the other hand, defining too narrow a system makes it difficult to fully understand interactions at higher levels, such as the interplay between water supply and vegetation if the system definition is at the cellular level.

APPLICATION TO RECEPTION PLANNING

The first task facing the reception manager is to

adequately define the system being managed. In this thesis, the base-level reception process, shown in Figure 5, is defined as the system. Thus, the feeding, billeting, transportation, and other processes are defined as subsystems within the reception process. The inputs to the system are personnel and cargo which have been output by other systems (i.e., base mobility processing or the ALC warehousing system). Additional inputs are resources such as food, vehicles, tents, etc. These are used by the various subsystems to produce services which are provided to the personnel and cargo flowing through the system. The desired final outputs of the system are the timely movement of personnel and cargo which have had their needs (food, shelter, etc.) satisfied during their stay within the system; an acceptable level of service provided to nondeploying and retrograde personnel; and, efficient processing of retrograde cargo. Furthermore, the system should accomplish these objectives while not contributing to a delay in any aircraft departure (12).

In designing the reception system, the managers must consider five characteristics basic to all systems. These are the system's objectives (with performance measures), its environment, its resources, its components, and its management. In these terms, the reception process can be described as follows:

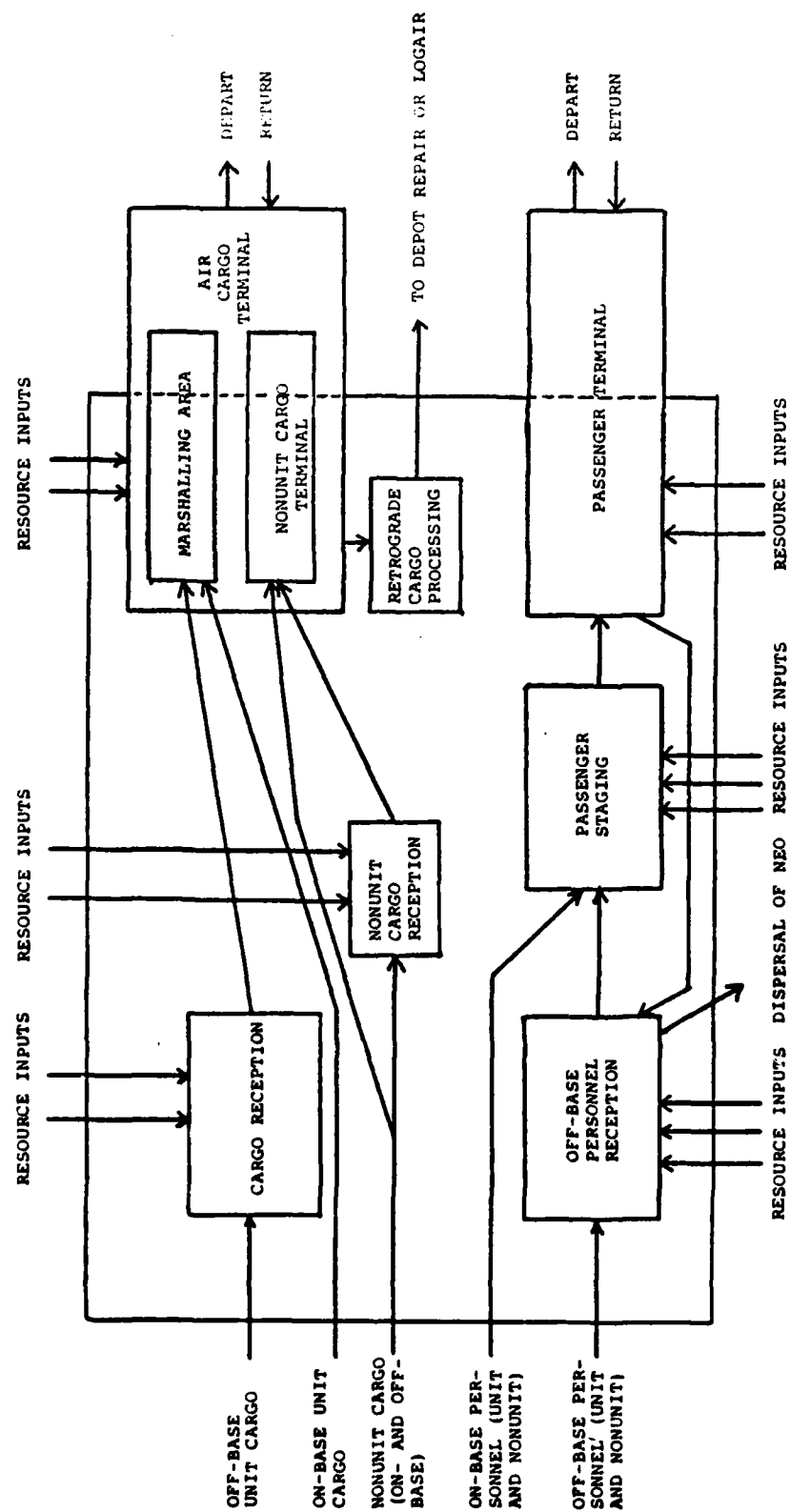


Figure 5: The Reception System

OBJECTIVES

The reception process is a service-oriented system, in which the ultimate objective is a satisfactory level of service provided to each client (whether deploying, non-deploying, or retrograde personnel or cargo) while not contributing in any way to delays in aircraft departures. The managers of the various subsystems must establish the objectives for their areas which will help meet the overall system objectives. Examples of these subsystem objectives might include:

(1) Nondeploying personnel (such as mobilization augmentees) will be billeted in permanent living quarters and fed in permanent dining facilities.

(2) Transient personnel with more than 18 hours before departure will be billeted in on-base permanent structures to the maximum extent possible. When all permanent structures are filled, 20-man tents will be used. All billeting quarters will be heated if temperatures are below 40° Fahrenheit.

(3) Transient personnel will be fed hot meals. Meals will be served continuously to accommodate the 24-hour operations.

(4) Transportation will be provided as needed. Sufficient transportation will be maintained to prevent any delay in aircraft departure.

(5) Sufficient parking will be provided for all

deploying vehicles. A sufficient number of wash racks will be provided to clean all vehicles within three hours of arrival at the APOE, unless they are to be used at the APOE while awaiting departure.

(6) Deploying cargo will be stored indoors if space is available. Cargo stored outdoors will be properly protected from the elements.

Each of these hypothetical objectives is stated in a manner which allows the manager to measure the success of the system or subsystem. It is important that each reception manager develop objectives which are operationalized in this manner.

ENVIRONMENT

The environment of the system includes all things which are outside the system's control but which influence the system's performance. The reception process environment consists of the schedule of arrivals and departures, the numbers of personnel and amounts of cargo, the weather, and the availability of resources, among other things.

RESOURCES

The system's resources are things which the system uses to achieve its goals. The resources of the reception process are implicit in the list of objectives above. By definition, the reception process is an open system, since

it can import resources from the outside environment (i.e., food, tents, rented vehicles).

COMPONENTS

The system's components are the functions it must perform in order to achieve its objectives. For the reception process, the components include erecting tents, cooking meals, driving buses, moving cargo, etc.

MANAGEMENT

Finally, the system's management incorporates planning and controlling into the system. Planning involves all the previous aspects: defining objectives, examining the environment, allocating resources, and organizing the components. All these steps must be accomplished in order to arrive at a viable system. Controlling involves managing the system while it is functioning. This requires that the managers both examine the execution of the plans and change the plan as needed. This is made necessary by the certainty of change in any open system (16:11). The reception process is extremely vulnerable to changes in both its environment and its resources. The schedule under which it functions is determined by persons and events far removed from the APOE, and is subject to drastic changes in order to meet battle area requirements. Similarly, the resources available to the process are not to be considered constant. Vehicles may break down, food may become scarce due to high demand in the

local area, and all resources may become critical due to an acceleration in arrivals or a slowdown in departures (12).

PROCESS DESCRIPTION

As has been mentioned, the reception process is a service-type system, which produces services to be rendered to the personnel and cargo flowing through it. The personnel and cargo flows are essentially independent, and will be discussed separately. The personnel flow will be considered first, followed by the cargo flow. The following discussion is not based on any particular reception plan. It is, instead, a general outline of the dozens of factors which must be considered by the reception managers.

PERSONNEL FLOW

Figure 1 introduced the different categories of personnel which enter the reception process, and briefly explained the route each follows. Figure 6 is a more detailed representation of the reception/aerial port process. Personnel may arrive by any number of routes, including bus, organic convoy, rail, military air, or commercial air. While most will report directly to the base, any who arrive at other locations (such as the train station or commercial airport) must be transported to the base (5; 12). The first stop for deploying personnel is at the reception point, where predeployment actions (ID cards, shot records, etc.) are verified. (Actions for nondeploying personnel will be

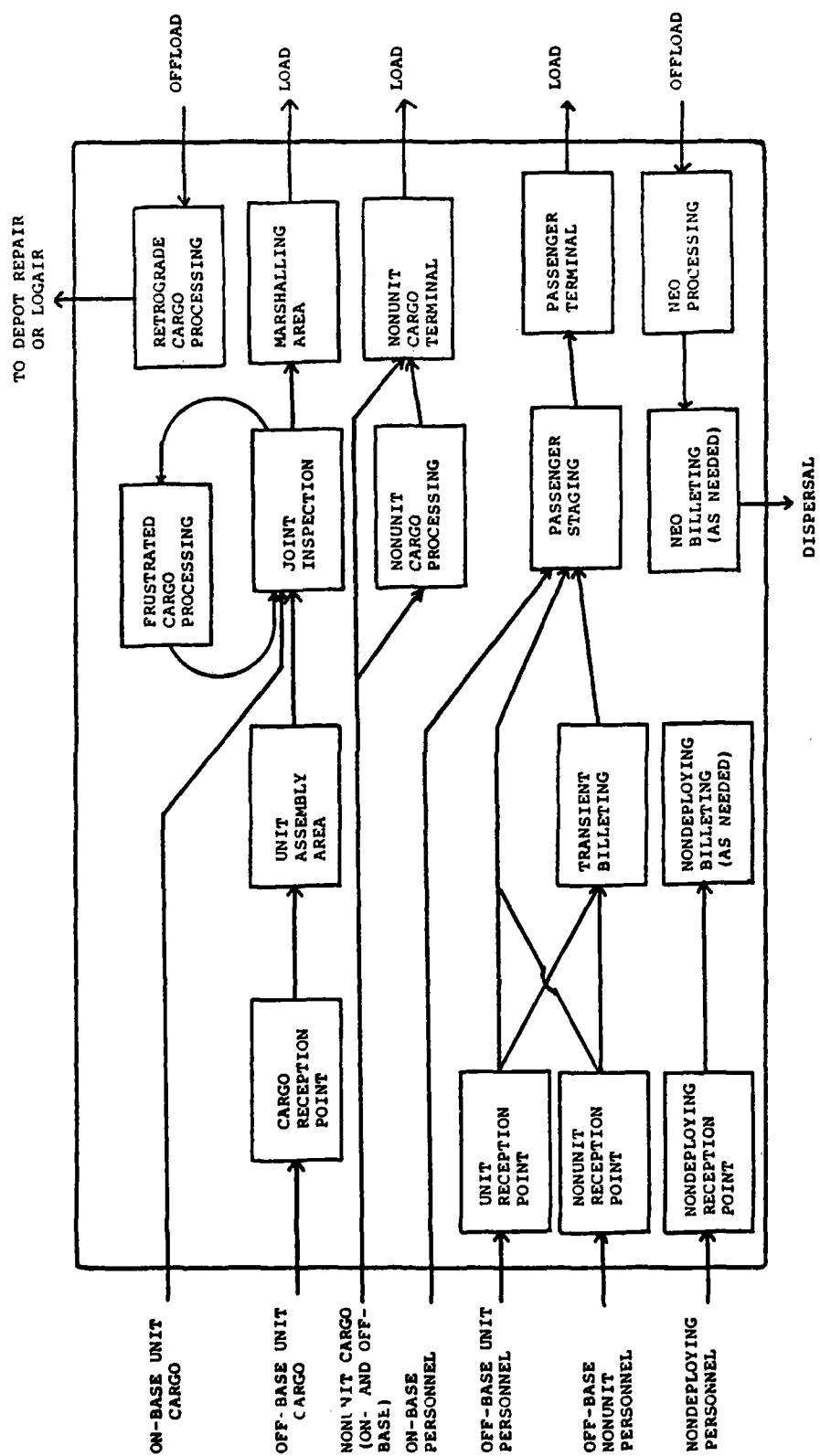


Figure 6: The Reception Process Flow

discussed later.) This action may be split into more than one area of responsibility, with units reporting to one reception point and nonunit-related personnel reporting to another. Figure 6 reflects this option. Each reception point has ready access to hospital, pass and identification, and legal personnel who can correct most discrepancies.

Based on the scheduled departure time for the individual or unit, a decision is made at the reception point as to whether billeting is warranted. If it is not, the unit or individual is directed to the passenger staging area at or near the flightline until they are needed in the passenger terminal for final processing. Space in the staging area is allocated and transportation is summoned if needed. If billeting is warranted, it is allocated and again transportation is summoned if needed. The unit or individual is sent to the assigned area until just prior to the scheduled departure time.

If this is a nondeploying unit or individual, the reception point actions are geared more toward determining the duty assignment(s) and accommodation requirements. Many mobilization augmentees will reside in the local area, and thus require no billeting and few, if any, meals (20:D-2-1). Some units and individuals will be coming from outside the commuting radius, however, and accommodations must be made for them. Generally, it is desirable to put the nondeploying personnel into permanent facilities. These might be dormitory rooms vacated by on-base personnel who have de-

ployed, reactivated dormitories, Visiting Officer Quarters (VOQs), or off-base contract quarters (20:4). Whatever the billeting arrangement, the managers must consider the demands it will place on transportation resources (20:D-1).

At both the billeting area and the passenger staging area, there will be a requirement for messing facilities. There could be several separate messing areas, depending on the particular situation. The critical point is that the capabilities of each facility be matched to the number of personnel expected to use it. (A simple head count will not suffice, as some units may be self-sustaining (6). Units not requiring messing facilities must be identified when the reception plan is being developed.) In addition to these facilities for the transient personnel, the permanent base facilities must be able to accommodate the permanent party and mobilization augmentee population (20:D-1). The need for shuttle bus transport for the latter group must be taken into account as well, depending on the distance they must commute. Another factor which will increase the demand for intra-base transportation is introduced whenever areas around the flightline must be closed to Privately Owned Vehicle (POV) traffic, either because the space is needed for the marshalling area or because of security precautions. In either case, shuttle transportation is needed for personnel working in the restricted area (21:4).

In addition to messing, the transient billeting

facilities must include shelter (be it a hangar, reactivated dormitory, or tent city), sanitary facilities (latrines, showers, trash disposal, etc.), and miscellaneous services such as heat, light, and communications stations (12).

At the appropriate time, the units or individuals proceed from the passenger staging area or the transient billeting area to the air passenger terminal where they are put through the final passenger processing. The terminal must have adequate personnel to accomplish the required briefings, and sufficient space to allow each group of passengers to be held separately once the processing is complete (12). Shortly before departure, the passengers board their aircraft. Once again, ground transportation is allocated as necessary. Once the personnel have departed, they are out of the system and no longer place demands against its resources.

Another input to the reception process is the unknown number of retrograde personnel, which may include civilians, dependents, and wounded military personnel. The civilians and dependents (referred to as Noncombatant Evacuation Operations (NEOs)) are not quantified in any current plans, but will probably enter the reception process for a short period of time before dispersing (12; 15; 24). The wounded will be taken directly from the aircraft to the hospital by hospital personnel, and are one exception to the rule that everything coming through the APOE passes

through the reception process (12). (While the hospital must have plans for dealing with this workload, this thesis considers the hospital to be outside of the reception system.)

The final category of personnel which may enter the reception process consists of those persons who are: (1) active duty on leave or temporary duty status away from their home station or, (2) reserve or guard personnel away from their reporting location when called up. These personnel may report to the nearest military base for transportation to their home station. The impact of this category on the reception process is extremely difficult to quantify, but until it can be shown to not have a significant impact it cannot be discounted (12; 15).

CARGO

The flow of cargo through the reception process is more complex than the personnel flow, due to the greater variability in the types of materials and the requirements they will place on the reception process. Further complexity is introduced by the vague division of responsibilities. As of May 1982, the issues relating to who would be responsible for what in the various stages of cargo movement were still being debated among the services and Major Commands (MAJCOMs) (12). Therefore, this chapter will only identify the necessary actions, deferring recommendations of respon-

sibility to a later chapter on policy recommendations. The following discussion will consider each type of cargo in turn, with an explanation of the requirements which will be placed by that type. Next, it will explain the general concept of cargo reception, pointing out the means of dealing with the various requirements.

UNIT-RELATED CARGO (URC)

The first type of cargo to be considered is described as unit-related. This consists of equipment and supplies which are specifically identified as belonging to a particular unit. This cargo may or may not accompany its unit; in some cases the cargo may precede the personnel, in other cases the opposite may hold true. This cargo may consist of virtually any type of material, from first aid supplies to vehicles and field artillery. The demands to be placed against the reception process will depend on the specific type of material, whether it comes from an on-base or off-base unit, and whether or not it is ready to load on the aircraft when received. MAC has published specific guidance on preparing cargo for airlift (19). For off-base URC, the reception process must provide enough space and equipment to allow those preparations to be completed. This includes wash racks for vehicles, pallets (including nets and straps) for cargo requiring them, and shelter facilities for building up the pallets in the forward assembly area (11). Since

some unit-related cargo will not be accompanied by its personnel, the reception process must also provide the labor for these activities when the URC is unaccompanied (12). Once ready, the off-base URC is delivered to the Mobility Air Cargo Terminal for the final joint inspection and marshalling (11).

For on-base URC, the preparatory actions will be accomplished in the unit assembly area before the cargo is delivered to the Mobility Air Cargo Terminal for joint inspection and marshalling. Therefore, the only requirements placed against the APOE for this type of cargo are for inspectors, space in the marshalling area, materials handling equipment, and load teams (11).

NONUNIT-RELATED CARGO (NRC)

The second major category of cargo is nonunit-related. As the name implies, this is materiel which is not identified as belonging to a specific unit. Like unit-related, it can be virtually anything. It will come from both on-base facilities (such as the ALC warehouses) and off-base (such as the Army storage depots). NRC will place demands on the reception process similar to those placed by the unit-related cargo. In addition, it will place demands against the Surface Freight Section of the base transportation function, because shipping documentation must be processed before the cargo can be sent to the air cargo

terminal (10).

Certain types of cargo will place their own unique demands. Explosives must be handled in accordance with established quantity-distance criteria. Vehicles must have adequate parking space. Certain cargo will require specialized packing materials which may be in short supply. Some of these requirements can be forecast with reasonable certainty. Others will remain unknown until execution because the war plans deal only in tonnages, not in specific items (21:iii).

RETROGRADE CARGO

The last category of cargo which will be encountered is retrograde cargo, consisting mostly of battle damaged repairables or other equipment destined for depot-level repair. This, like the retrograde personnel, is largely an unknown. MAC has not yet indicated whether the cargo will be flown to its respective depot or merely left at the first aerial port the aircraft lands at. Regardless, the retrograde cargo must be sorted and routed to the appropriate destination - whether it be transported locally by truck or to another ALC by LOGAIR (12).

CARGO RECEPTION FLOW

The flow of unit-related cargo through the process will generally begin at a reception point, where cargo terminal personnel will identify and route the cargo. Any

cargo in need of further processing (or any early arrival) is sent to a Unit Assembly Area, which contains the facilities and equipment such as wash racks, pallets, nets, and tiedowns. For cargo originating at the APOE, this initial routing can be handled by telephone or messenger communication between the control center and the warehouse or unit area. Once the further processing is completed, the cargo is presented for joint inspection, where air cargo terminal personnel and the owners of the cargo (if present) perform the final inspection to insure that it is ready for airlift. Should it fail, it is sent to the frustrated cargo area for corrective action. When it passes the joint inspection, it is moved to the marshalling area where the aircraft loads are assembled into "chalks" (8; 12).

On-base nonunit cargo is prepared for shipment in the storage area and sent to the air cargo terminal in airlift-ready condition. Off-base nonunit cargo is received by the Surface Freight Section of the base transportation function, where the shipping paperwork is processed. It is then forwarded to the air cargo terminal, where it receives the necessary preparations for airlift and is formed into chalks (10).

At the departure time, the cargo is loaded onto the aircraft by aerial port load teams. The specific demand for these teams and the associated loading equipment will be a function of the number of departures in a given

period of time, and the number of personnel and loaders available (12).

METHODOLOGY

THE PHASE I MODEL

The Phase I model assumes that the reception plan is either non-existent or not well defined. Therefore, the primary purpose of Phase I is to provide basic information necessary to develop the plan. This includes the following:

(1) the population on station in each of the following categories over time:

- mobilization augmentees and non-deploying personnel
- transients in the following areas:
 - unit reception point
 - nonunit reception point
 - transient billeting
- on-base or transient personnel in the following areas:
 - passenger staging area
 - passenger terminal

(2) short tons of cargo (vehicular, non-vehicular, bulk, oversize, and outsize) in the assembly area or air cargo terminal in each of the following categories over time:

- on-base unit-related
- on-base nonunit-related
- transient unit-related
- transient nonunit-related

(3) short tons of cargo (as above) in the marshaling/chalks area

(4) the number of passengers and tonnage of cargo expected to depart each day.

This phase of the model will provide a 'first cut' estimate of the workload to be encountered by the APOE in a given wartime scenario. It will accomplish this by using a very simple network model to represent the reception process, which assumes that all resources (feeding, billeting, cargo processing area, etc.) are essentially unlimited. Input data will be drawn from the Joint Deployment System (JDS) data base. As was explained in Chapter 1, this data base pulls together the Joint Operation Planning System (JOPS) Time Phased Force Deployment Data (TPFDD), and the MAC and MTMC movement tables. Prior to execution of a plan, many fields in this data base are unknown, and others are expressed only in days (i.e., D003) rather than as specific times (2; 5). However, in this predictive mode, the values in the data base provide sufficient accuracy on which to base a simulation which will use a range of values rather than a point estimate for arrival and departure times. Currently available documents which show the data on departure

rates can be used to validate this model's predictions. Further detail concerning manipulation of the input data will be given in the chapter discussing computerization.

Phase I is needed only once for each APOE. The best approach is to use the war plan with the greatest expected workload. The value of this phase is its vagueness. Because it does not attempt to model a specific process, any and every APOE could use it to determine the expected workload under any existing war plan. All that is required is the appropriate input data.

Given the information obtained from the Phase I run, the next step is to develop a detailed reception plan which will define the levels of resources to be allocated to handle the expected workload. This leads to the Phase II model.

THE PHASE II MODEL

In developing the reception plan, the planners must take the information from Phase I and allocate resources to meet that workload. Knowing how many people will be arriving each day, they can allocate enough people to process the arrivals with minimal delay. Knowing the total population of transients and augmentees, they can plan on serving a certain number of meals on each day. Once this requirement is determined, they can allocate cooks and facilities, and the commissary can plan on obtain-

ing the needed supplies. Knowing the expected number of people needing billeting, the managers can allocate sufficient spaces in available facilities and/or allocate land for a bivouac area. Knowing where the people will be located will allow the planners to locate the feeding facilities for optimum service, and will also allow them to estimate the need for transportation (which was excluded from the Phase I model). All of this information is then built into the Phase II model of the reception process.

In short, Phase II embodies a complete, detailed reception plan. Due to this, Phase II models cannot be as readily transferred among APOEs as could the Phase I model. However, once Phase II is complete for a particular APOE, any war plan's tasking can be cast against it. This allows the planners to see if their reception plan is still adequate. Sensitivity analysis can also be performed against the Phase II model to identify the areas which are most likely to become critical areas under different contingencies. This analysis will allow the managers to better anticipate the potential problem areas in their system.

The primary thrust of this thesis is to develop the models through the validation and verification stages. Experimentation with actual data is deferred to the future users of the model. That experimentation should include varying the levels of resource availability

and exercising policy options. Further experimentation with the model should involve using input drawn from each of the established war plans.

THE PHASE III MODEL

Phase III is essentially Phase II being run under execution conditions. The primary differences are in the length of time being simulated, and in the input data. Under execution of a war plan, MAC and MTMC prepare detailed flow plans for a defined period of time into the future. The Phase III model will use these detailed flow plans, which have much more precise estimates of arrival and departure times, as input data. Since these plans extend only a short time into the future, the Phase III model will terminate the simulation at that point.

This use will allow the manager to determine the projected flow of personnel and material for the next few days. Under a wartime scenario, this information could be invaluable in averting or minimizing backlogs and delays. In this manner, the managers can insure that the system goals, to adequately serve all clients without causing any delays, are met.

CHAPTER SUMMARY

This chapter has described the reception process from a systems point of view. The boundaries and environment were defined, and the major subsystems, inputs, and

outputs were introduced. Next, the system was explained in detail in terms of the flow of personnel and materials through the process. The final sections explained the modelling approach to be used. The next chapter will introduce SLAM II network simulation, and detail the computerization of the Phase I model.

CHAPTER 3

PHASE I COMPUTERIZATION

INTRODUCTION

This chapter discusses the computerization of the Phase I model. The discussion includes an overview of computer simulation with an explanation of why simulation was chosen to help solve the problem facing the APOE managers. Next, a detailed Phase I model is presented, followed by an outline of the Phase I output products. Assumptions are included with the applicable discussion rather than listed separately.

COMPUTER SIMULATION AND PHASE I MODEL

Computer simulation is considered vital in the resolution of the problems stated in Chapter 1, due to both the nature of the problems and the capabilities of simulation. The APOE and the reception process have been shown to be systems consisting of inputs, processes, and outputs. The complex and dynamic nature of these systems has been discussed at length. Simulation is among the most flexible and powerful means of dealing with this type of situation. According to Pritsker and Pegden (14:1),

- Simulation models can be employed at four levels:
- As explanatory devices to define a system or problem;
 - As analysis vehicles to determine critical elements, components and issues;

- As design assessors to synthesize and evaluate proposed solutions;
- As predictors to forecast and aid in planning future developments.

Each of these four applications will be used in this thesis. First, although definitions of the system and problem have been presented, the simulation of the system may identify underlying problems. Second, these models will be instrumental in identifying the critical resources and processes which may cause bottlenecks or delays in the movement schedules. This use, together with the third and fourth points above, is the essence of the Phase II model.

The particular simulation language chosen was SLAM II, written by A. Alan B. Pritsker and Claude Dennis Pegden (see reference 14). SLAM provides tremendous flexibility and power to the modeller by allowing the combination of a network approach with unlimited user-written subroutines. This is referred to as the combined network-discrete event approach (14:315). The strength of the network approach lies in its easily interpreted visual presentation of the system being modelled. By using a set of symbols, the modeller draws a picture representing the flow of entities through the system. Symbols are available to represent queues waiting for either servers or resources, service activities, value assignments, and other frequently encountered events within the system. After drawing the picture, or network, the modeller simply transfers the

information in the picture to the program code, using a standard SLAM format.

Any events occurring in the system being modelled which cannot be represented by the standard network symbols can be included as a discrete event, in which the modeller instructs the simulation to leave the network momentarily and follow a set of instructions in a separate user-written subroutine. Any such subroutines are written in standard FORTRAN (as is the SLAM simulation language), and included in the input to the computer. In this way, any conceivable situation can be modelled, regardless of how complicated the logic may be. SLAM further simplifies the task of the modeller by making available an extensive set of prewritten subroutines and functions which may be invoked within the user-written subroutines.

PHASE I COMPUTERIZATION

The Phase I model, as defined in Chapter 1, provides the managers with a "rough cut" estimate of the workload to be encountered during a given deployment. To accomplish this, the user must first translate the available data into a form with which the simulation can work. The model must then accept that input and simulate the activities of the reception process in dealing with the flow. Finally, it must produce an output of the workload information in a form useful to the managers.

Figure 7 shows the steps taken to run the Phase I model. The model uses the combined network-discrete event approach, since the translation of war plan flow data cannot be handled by pure network procedures. The following discussion will consider the preliminary input data preparation, the variable initialization, the discrete portion of the model, the network portion (broken out by personnel and cargo), and the output products.

PRELIMINARY DATA PREPARATION

As has been mentioned, the flow data which drive the simulation come from the prepared war plans. The primary documents of interest are the Time Phased Force Deployment Data (TPFDD) listings for the unit and nonunit personnel and cargo. These documents show information for each Force Requirement Number (FRN), Cargo Increment Number (CIN), and Passenger Increment Number (PIN); including both descriptive data (such as personnel strength and cargo tonnage) and movement data. (For ease of discussion, the acronym 'FRN' will be used to indicate both unit and nonunit cargo and personnel unless otherwise specified.) In the pre-execution environment, the movement data consist of several times expressed as days after initiation of the plan (i.e., D003). The Available to Load Date (ALD) shows the day the FRN should be at the APOE. The Earliest Arrival Date (EAD) and Latest Arrival Date (LAD) show the desired

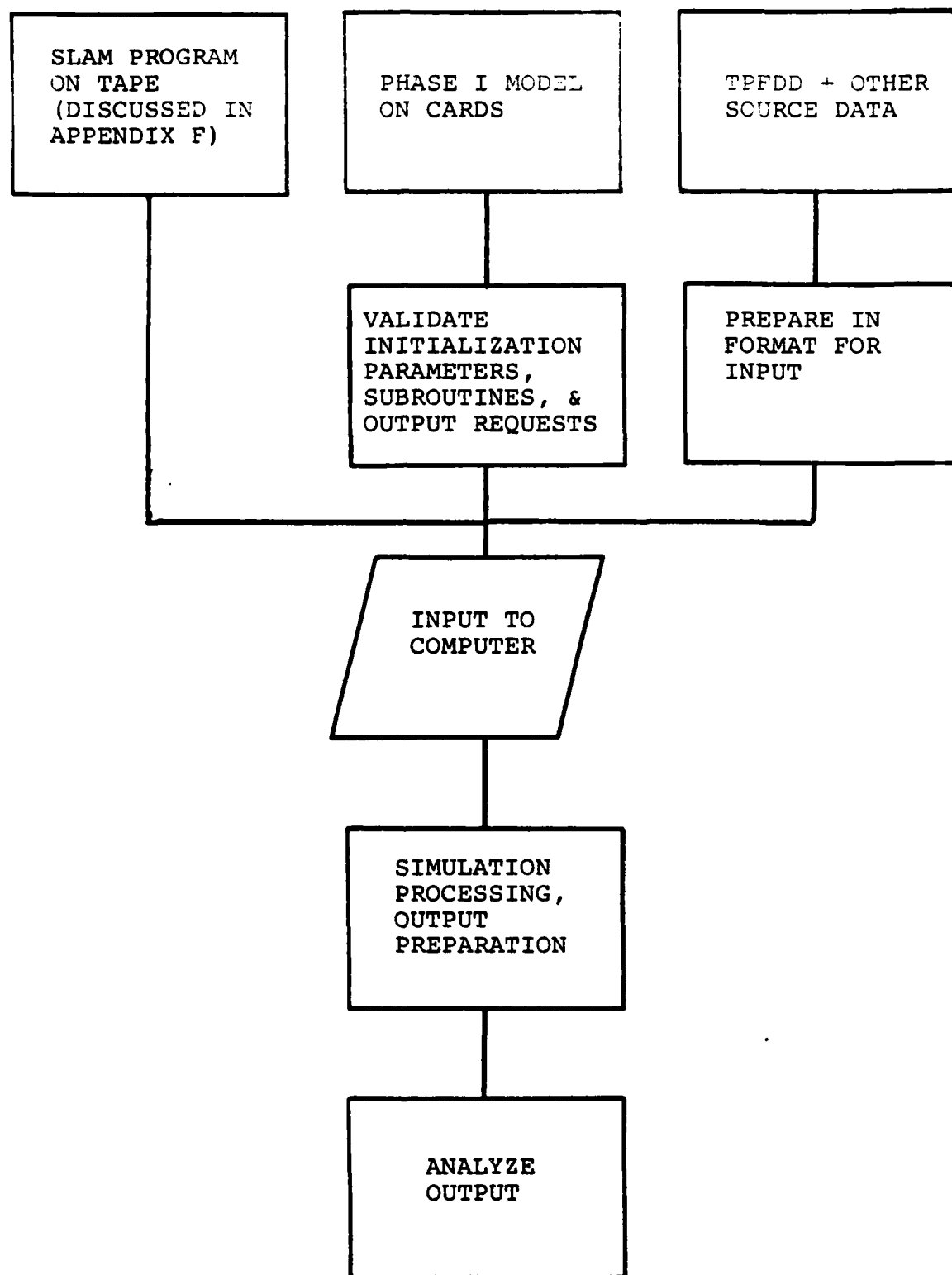


Figure 7: Operation of the Phase I Model

window for arrival at the APOD. The Estimated Departure Date (EDD), which may be blank, shows the time established by MAC as the likely pickup time at the APOE.

In preparation for the simulation, the modeller must translate the TPFDD into a form more readily useable. For applications at Wright-Patterson AFB, this is accomplished by the use of the short FORTRAN program shown in Appendix B. This program is simply a formatted 'read' statement followed by a formatted 'punch' statement. The thrust of this program is twofold: to select only those data fields which are of interest, ignoring the others; and to get the data onto a medium (cards) which is readily transferred from the Honeywell source computer to the Cyber computer which contains the SLAM software. (System differences prevent the Cyber from reading Honeywell tapes.) The result of this step is a card deck which contains all the information from the TPFDD which the simulation needs, with each card representing one FRN. Should TPFDD tapes become available which can be read by the Cyber, this step can be omitted. In either case, further input data must be obtained on the mobilization augmentees, as these may or may not be included in the TPFDD (5). These data are obtained from the Reserve Personnel Office at HQ AFLC. After any duplications are eliminated, the data are punched into cards in the same format, or added to the TPFDD tape for direct input.

VARIABLE INITIALIZATION-SUBROUTINE INTLC

A powerful feature of SLAM is the availability of "global" variables, which are accessible at any point in the model. These variables can be used to track changes in the system or establish decision criteria. Subroutine INTLC initializes the global variables used throughout the simulation. A listing of this subroutine appears in Appendix B. The user's task is to insure that all of the subroutines prepared for this thesis are appropriate for continued use, and to make changes as needed.

The global variables in SLAM used in this model are found in the XX(.) array, which consists of 100 variables. These are used to define parameters and keep track of population and tonnage totals at any given point in time. At the conclusion of the simulation, selected variables are plotted over time as part of the output report.

Since most of the XX(.) variables in this application are initially 0, Subroutine INTLC first sets the entire array to 0. Then, those variables not 0 (predominantly the decision criteria and parameters) are individually set. Table 1 (Appendix C) lists all XX(.) variables and their definitions. The initial values used in this thesis are shown in the INTLC listing (Appendix B).

THE DISCRETE EVENT PORTION OF THE MODEL

The discrete events in this model are used to

process the input data. This has no direct relationship to actual events at the APOE; rather, it is an extension of the preliminary data preparation with the computer doing the work. The subroutines are called from the network by EVENT nodes. These nodes, when triggered by an incoming entity, instruct the processor to go to a user-written subroutine, follow whatever instructions are found there, and return to the network. Three EVENT nodes are employed in the Phase I model: EVT1, EVT2, and EVT3 (Figure 8).

EVT1

Upon initiation of the simulation, one entity is generated out of the CREATE node CRE1 (Figure 8). No further creations occur from this node. The one entity immediately arrives at EVT1, which causes the simulation to call Subroutine EVENT(1). EVENT(1), as shown in Appendix B, reads in the input data previously prepared. After reading the data, it computes attribute values, assigns those attributes, checks for non-air transportable cargo, and files the FRN away for future use. After filing away each FRN, the EVENT will attempt to read another record, repeating the process until all FRNs have been processed and filed into File 1.

Attributes are the characteristics of each FRN, and may be used in many ways throughout the model. In assigning the attribute values, some may be read directly,

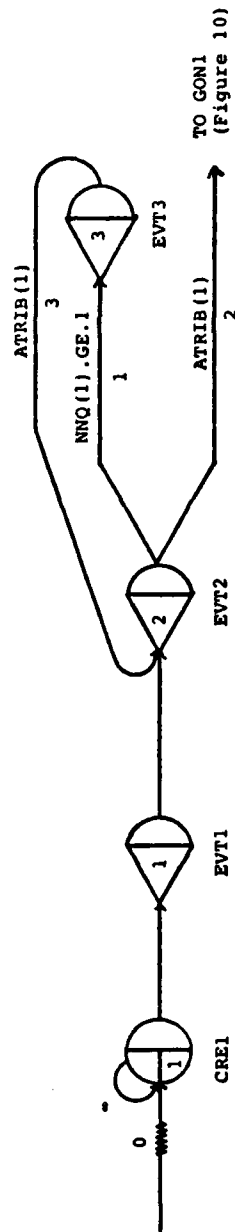


Figure 8: Discrete Event Portion

while others must be calculated based on some rather wide-ranging assumptions. The following discussion will consider each attribute in order of computation. Table 2 (Appendix C) lists all attributes with their definitions.

ATTRIBUTE 2: THE EXPECTED DEPARTURE TIME

The first attribute to be computed is the expected departure time. This is drawn from the EAD, the LAD, and the average flight time to the general area of the destination. Since it was decided to measure time in hours from initiation, the first step translates the EAD and LAD figures to hours by multiplying each by 24. The resulting figures equate to midnight of the respective days. Next, the code subtracts 24 hours from the EAD figure. This sets the earliest arrival time at the APOD as 0001 hours on the EAD, and the latest arrival time at the APOD as 2400 hours on the LAD. Next, XX(3) is subtracted from each of the figures thus obtained. XX(3) is initialized in Subroutine INTLC to be the sum of the flight time to the theater and the loss or gain in clock time during the flight. This gives the earliest and latest departure times from the APOE. The final step in the process feeds these two values to the SLAM random number generator as the lower and upper bounds on a uniform distribution, which returns a figure filed as Attribute 2.

The algorithm assumes that flight times are con-

stant to all parts of the theater. It also assumes that all FRNs will be scheduled by MAC to meet their EAD/LAD window, and that the resulting schedule follows a uniform distribution between the EAD and the LAD. Finally, it assumes that all FRNs, regardless of size, leave individually. They are neither broken into smaller groups (if too large for a single load) nor aggregated into larger groups (if too small).

These assumptions are not entirely realistic, but are made necessary by the lack of needed data. However, if the Estimated Departure Date (EDD) field were filled in, the above procedure with its estimation and assumptions would not be needed. Rather, the EDD could be used directly once converted into hours. Furthermore, if the MAC movement tables should become available, the problem of sorting the departing FRNs into aircraft loads would be resolved.

ATTRIBUTE 3: NUMBER OF PASSENGERS

The number of passengers is read directly from the input and needs no manipulation.

ATTRIBUTE 4: TOTAL SHORT TONS OF CARGO

To obtain the total short tonnage of cargo, the figures in the bulk, oversize, and outsize short ton fields are totalled. This figure is then multiplied by

.10 to insert a decimal in the appropriate place, according to TPFDD convention (12). (Note: all weight measures in this simulation are short tons. One short ton = 2,000 pounds.)

ATTRIBUTES 7 TO 9: BULK, OVER- AND OUTSIZE TONNAGE

These fields are read directly from the input, requiring no manipulation other than the insertion of a decimal as noted above.

ATTRIBUTE 10: TYPE OF ENTITY

The preliminary data preparation included the insertion of a code indicating the class of the entity, with a "2" indicating unit-related and a "3" indicating nonunit-related. This step further refines this code by reading the code and the fields showing the origin and destination. If the destination is the APOE base itself, the type is coded as non-deploying (type=1). If the type was coded as unit-related, and neither origin nor destination is the APOE base, the type is recoded as off-base deploying unit (type=2). If the type was coded as nonunit, it would be recoded as an off-base deploying nonunit (type=3). Similarly, if the origin is the APOE base, the entities are recoded as on-base deploying units (type=4) or non-units (type=5).

ATTRIBUTE 5: VEHICULAR SHORT TONS

This figure is estimated from the total tonnage, based on the type of entity. The user has the option of using the sum of the oversize and outsize cargo as the vehicular estimate, or using MAC averages. The option desired is indicated in Subroutine INTLC during input to the computer. The MAC figures indicate that for unit-related cargo, 80% will be rolling stock or vehicular cargo; while for nonunit cargo only 10% will be vehicular (22:1). Therefore, if the MAC option is selected this step checks the type of entity previously assigned, and multiplies the total tonnage by the appropriate factor. If the entity is non-deploying, a value of 0 is assigned, on the assumption that any cargo brought in by non-deploying FRNs will not have an impact on the reception process workload.

ATTRIBUTE 6: NONVEHICULAR SHORT TONS

This figure is derived by subtracting the vehicular tonnage from the total tonnage. This assumes that all cargo is by definition either vehicular or nonvehicular. The MAC figures are based on the aggregate, and may not be true for individual FRNs. This simulation assumes that the differences are not significant. This assumption must be remembered when interpreting the output products. The variability in this and other areas of the reception process could be modelled by techniques available

in SLAM. However, this thesis does not attempt to use those techniques, choosing instead to establish the basic framework of the model. Areas appropriate for those elaborations will be identified in Chapter 6.

ATTRIBUTE 1: THE EXPECTED ARRIVAL TIME

The expected arrival time at the APOE, which is expressed in hours after initiation, can be derived in two ways. The first uses the Available to Load Date (ALD) as its starting point. By feeding the ALD to the random number generator, an expected arrival time can be derived which reflects the intent of the war plan. However, in the data tapes initially obtained for this thesis, the ALD was deleted when the tape was declassified. Therefore, a second method was developed which established a 24-hour window for arrivals. The earliest arrival is 36 hours prior to departure (previously calculated as Attribute 2), the latest is 12 hours prior, and the most probable is 24 hours prior. These values are fed to the random number generator, which produces an arrival time drawn from a triangular distribution. The triangular distribution was chosen because of the ease of defining its parameters. Should the calculated arrival time be prior to initiation of the deployment, it is set to zero (which in effect says that the FRN will arrive immediately).

After assigning all attributes, the event checks

for non-air transportable cargo. None should be scheduled to move through an aerial port; if any is seen, a management notice is printed identifying the FRN.

After all this is done, the EVENT executes a call to Subroutine FILEM. The FRN is filed into File 1, which is sorted according to the value of Attribute 1 (the arrival time at the APOE) with low values first. It then repeats the process on the next FRN. Once all FRNs have been processed and filed, execution control returns to the network.

Thus, the product of EVENT(1) is a file (File 1) which contains all FRNs scheduled to move into or through the APOE, including their descriptive characteristics and scheduled arrival and departure times. Once these times have been set, the simulation will operate according to that schedule. Here again, SLAM has techniques which can introduce variability into the model (for instance, delaying a departure). However, this thesis will concentrate on the basic structure, leaving such refinement to future researchers.

EVT2

Immediately upon returning to the network, the entity initially created triggers EVT2. This causes a call to Subroutine EVENT(2), the coding for which is

shown in Appendix B. Each call to EVENT(2) will cause the first FRN in the file to be permanently removed. The next FRN moves up to take its place at the head of the line. The FRN which was removed has its Attribute 1 redefined as the time remaining until arrival by subtracting the current time from the scheduled time of arrival. It is then launched into the network with this new value of Attribute 1 being the time until it arrives at the next node. As shown in Figure 9, if there are more FRNs waiting in File 1, a "dummy" entity (whose sole purpose is to trigger the next node) is routed to EVT3. Execution control then returns to the network.

EVT3

If there was a dummy entity routed to EVT3, it executes a call to Subroutine EVENT(3). This subroutine determines the time remaining to the next arrival by calling Subroutine COPY, which makes a copy of the next to arrive FRN's attributes. It then subtracts the current time from the scheduled arrival time, which provides the time remaining to the arrival of the next FRN. It then releases a dummy entity, which is routed back to EVT2. Its arrival at EVT2 will exactly coincide with the scheduled arrival of the next FRN. Thus, when the dummy entity arrives at EVT2, it will cause the arriving FRN to be removed from

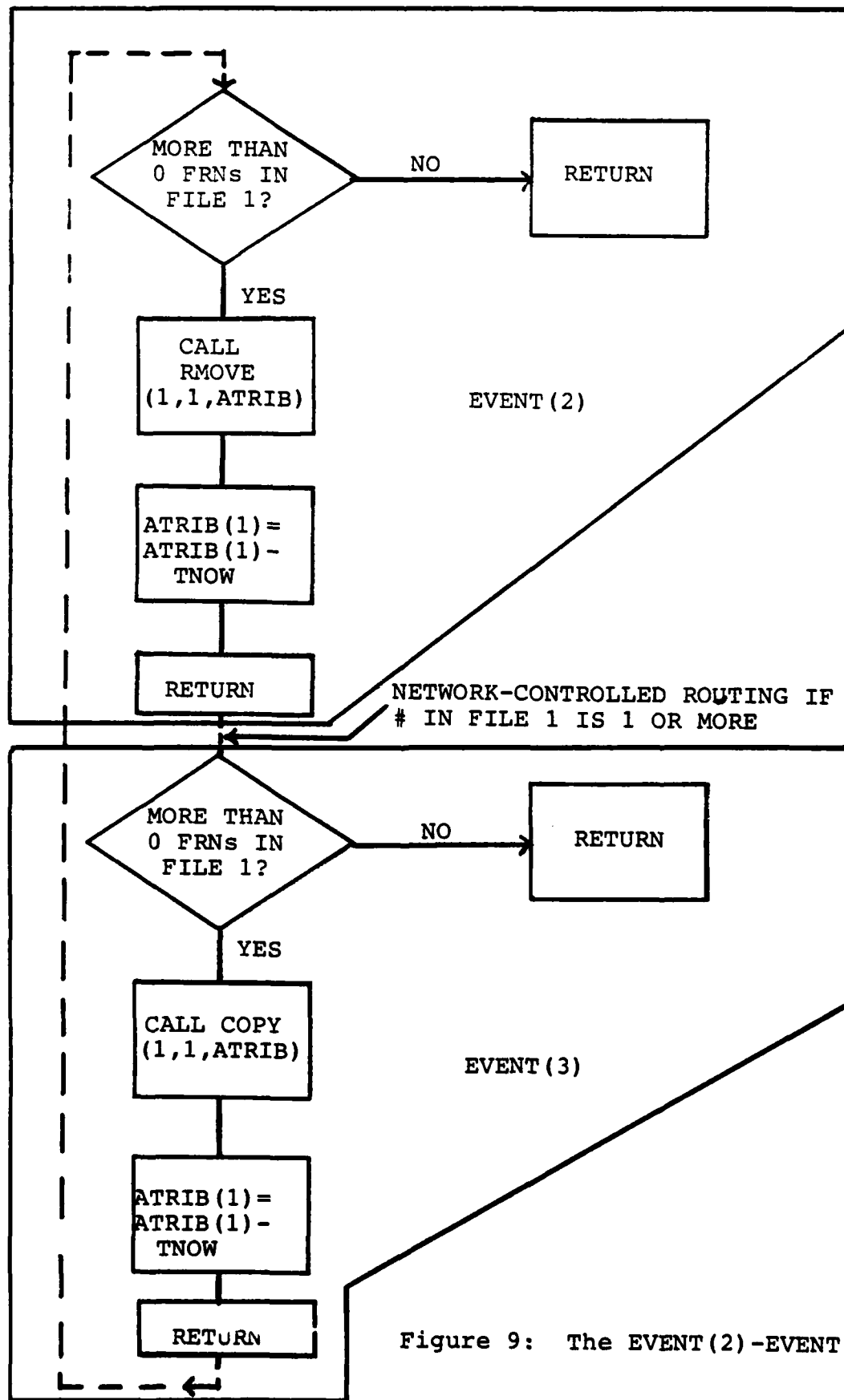


Figure 9: The EVENT(2)-EVENT(3) Cycle

File 1 and sent into the network as scheduled. The EVT2-EVT3 cycle will continue until File 1 is empty.

This logic is designed to limit the number of entities in the system at any given time. The alternative method is to release the entities from EVT1 directly into the network at time 0 with the duration to the next node equal to Attribute 1. However, this would result in several thousand entities in the network simultaneously (at least in the early stages). This, in turn, would result in excessive demands for computer time and core memory to keep track of all the entities. The chosen method results in only those entities representing FRNs which are currently in the system being active in the network, which places lighter demands on the computer resources.

THE NETWORK PORTION

Following the initial activities associated with node EVT1, nodes EVT2 and EVT3 remove FRNs from File 1 and release them into the network according to their arrival times. Appendix E shows the overall flow. The first node encountered is GON1 (see Figure 10), at which the FRNs are routed to the personnel and/or cargo subnetworks. Conditional branching is used, which examines the values of Attributes 3 and 4 (number of personnel and total short tons of cargo) to determine the routing. Should an FRN have both personnel and cargo, one FRN is sent to the per-

sonnel subnetwork and an identical copy is sent to the cargo subnetwork.

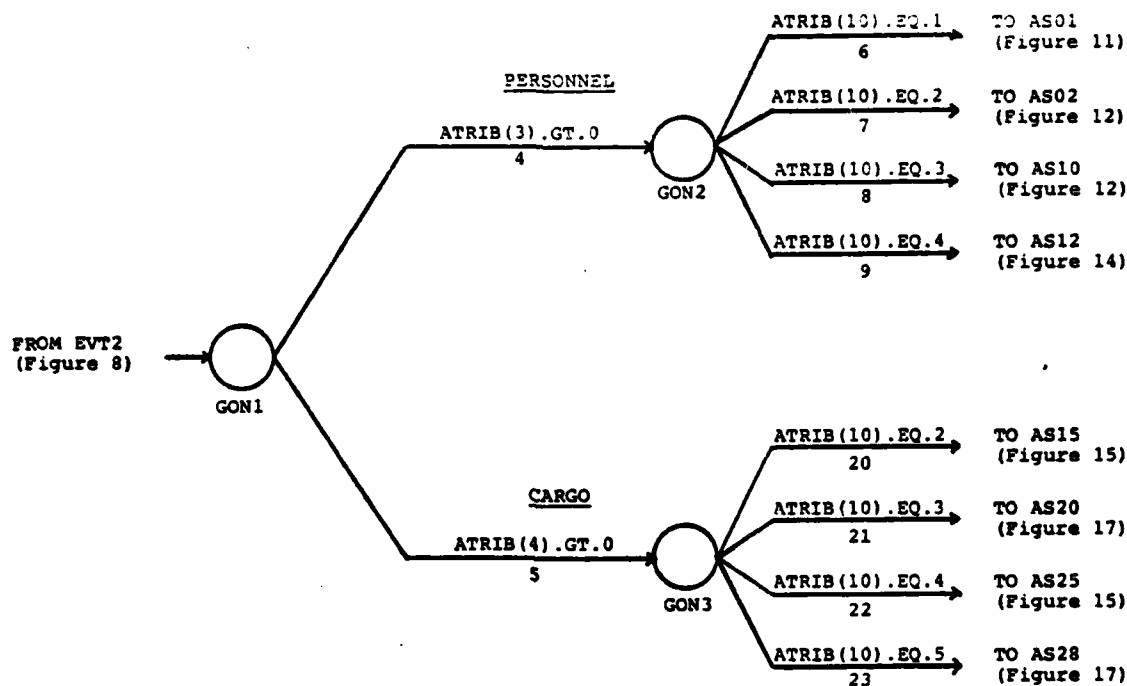


Figure 10: Cargo/Passenger Sorting

THE PERSONNEL SUBNETWORK

Any FRN sent to the personnel network will next encounter node GON2. At this node, conditional branching is again employed to route the FRNs according to their type, as reflected by Attribute 10. The routing is also shown in Figure 10.

As shown in Figures 10 and 11, any non-deploying FRNs (Type 1) will be sent to the non-deploying personnel billeting area. This area, represented by node AS01 (Figure 11), accounts for these persons by adding them to

the current non-deploying personnel population. This assumes that these persons do not deploy at a later date. Once added into this figure, the entities representing the FRNs are destroyed by node TER1, and are no longer active in the network.

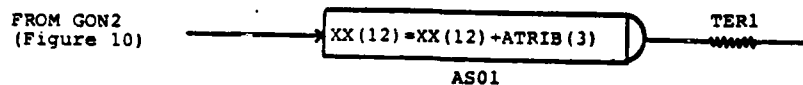


Figure 11: Non-Deploying Billeting

FRNs of types 2 and 3 (off-base unit and nonunit personnel) are routed to reception point stations represented by nodes AS02 and AS10 (Figure 12). They remain in these areas for 2.0 hours, as shown by activities 10 and 16. They are then subtracted from the number in those areas by nodes AS03 and AS11. Both types are then routed to node AS04, where Attribute 11 is defined as the time remaining to their scheduled departure. Once more, conditional branching is used to determine the routing from AS04. The user previously established in Subroutine INTLC a criterion for allocating transient billeting space based on the time remaining before departure. This value was placed in XX(8). If the FRN's Attribute 11 is greater than XX(8), it is routed to transient billeting. Otherwise, it is sent to the passenger staging area.

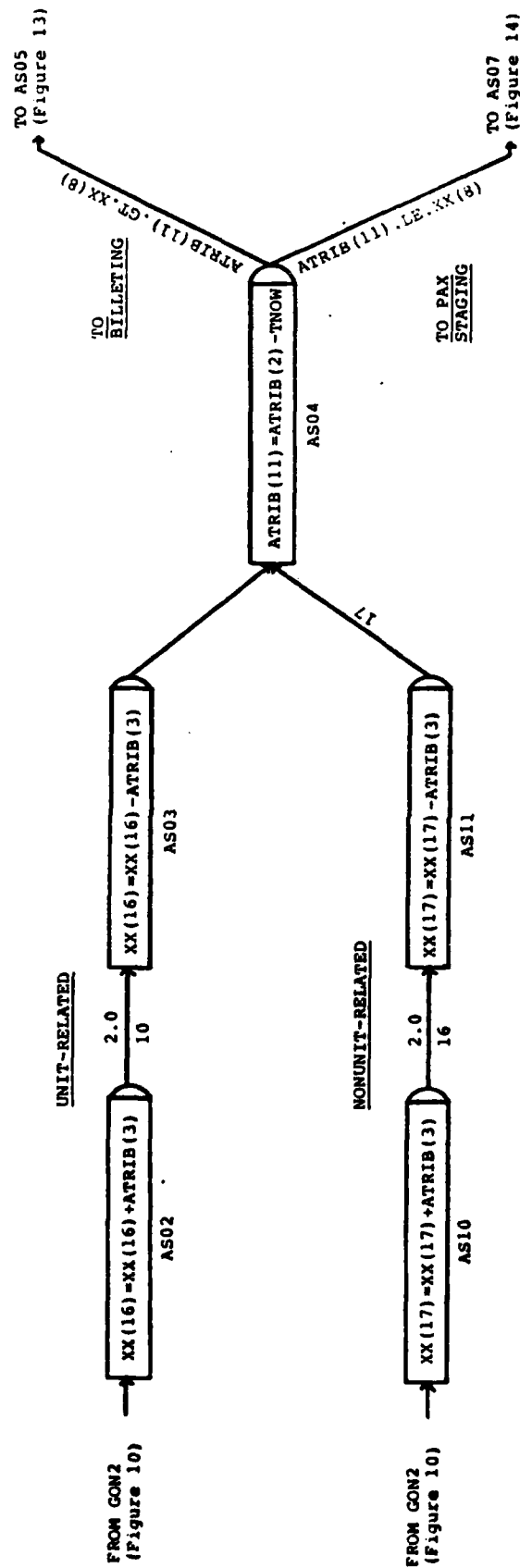


Figure 12: Off-Base Personnel Reception Point

The transient billeting area is represented by nodes AS05 and AS06 (Figure 13). Upon arrival to AS05, the FRN is added to the number in that area. Another criterion previously established in Subroutine INTLC, was how long before departure an FRN must leave billeting and report to passenger staging. This is placed in XX(6). By subtracting this figure, its Attribute 11 is reflected as the amount of time it will be in transient billeting before it must report to passenger staging. This is the duration of activity 13. After this time, node AS06 subtracts the FRN from the number in the area, and redefines Attribute 11 as the time before departure. The FRN is then routed to the passenger staging area.

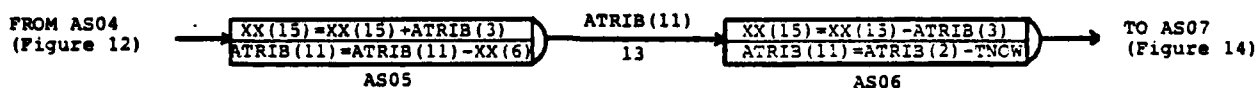


Figure 13: Transient Billeting

The passenger staging area is represented by nodes AS07, AS08, AS13, and AS14 (Figure 14). All off-base FRNs (Types 2 and 3) are routed into AS07, where they are added to the number in the area and their Attribute 11 is redefined once more. In this case, the amount of time that is required in final passenger processing (placed in XX(7) by Subroutine INTLC) is subtracted from Attribute 11, leaving it as the time they will spend in passenger staging. This

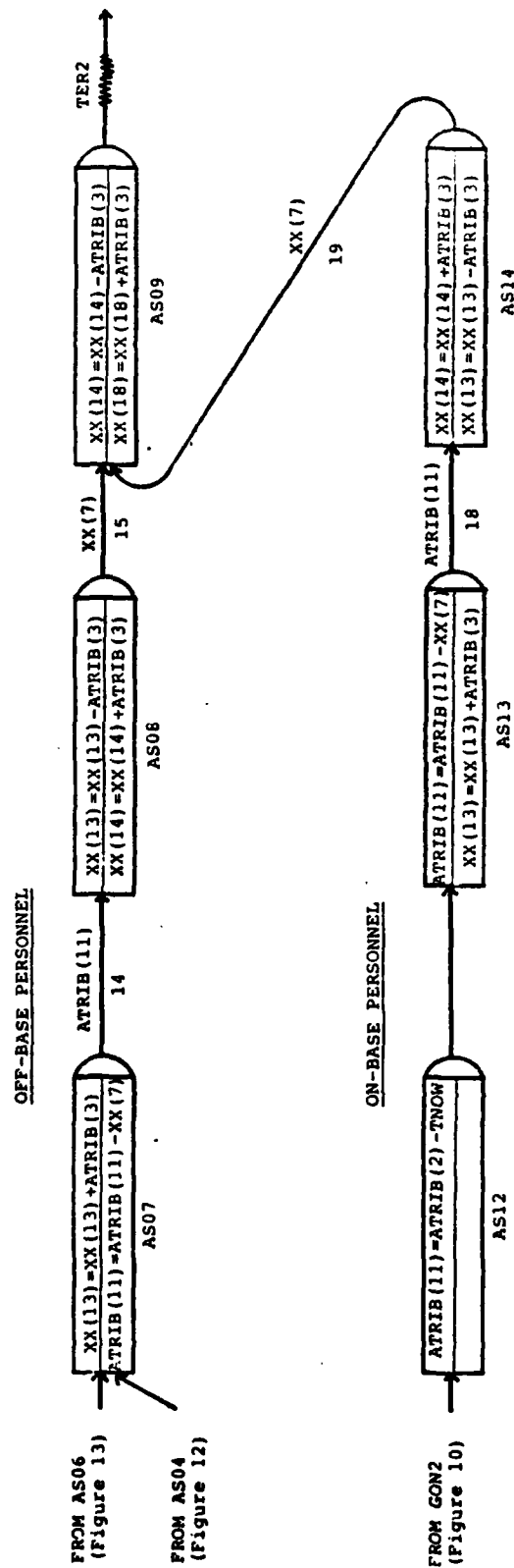


Figure 14: Passenger Staging and Terminal

is shown as activity 14. After this time, node AS08 subtracts them from the number in passenger staging and adds them to the number in the passenger terminal. The on-base FRNs (Type 4) also come through passenger staging after leaving the base mobility process (which is not included in this model). After being routed from GON2, these FRNs have Attribute 11 identified in the manner previously described. They enter passenger staging at node AS13, which is identical to AS07. They then proceed to AS14, where they are subtracted from the number in passenger staging and added to the number in the terminal.

The passenger terminal, also shown in Figure 14, picks up the FRNs from nodes AS08 and AS14. FRNs from both are routed to node AS09 (representing departures), where they are subtracted from the number in the terminal and added to the daily departure total. The routing is over activities 15 and 19, which have the duration of XX(7), the passenger processing time. Following release from node AS09, the entities representing departed FRNs are destroyed by TER2.

THE CARGO SUBNETWORK

Node GON1, with its conditional branching, routes FRNs with any amount of cargo to the cargo subnetwork. These FRNs first encounter node GON3, which closely parallels GON2 in that conditional branching is used to

further sort the FRNs based on their type, as reflected in Attribute 10 (see Figure 10). The branching has provision only for deploying FRNs (Types 2-5), assuming that any cargo owned by nondeploying FRNs would not impact on the reception process.

Off-base unit-related cargo (Type 2) is routed to the assembly area, represented by nodes AS15, AS16, and AS17 (Figure 15). Node AS15 adds the tonnage of each class (vehicular, nonvehicular, bulk, oversize, outsize, and total) to the amount in the assembly area. This area contains the facilities needed to prepare the cargo for airlift, including the palletization area, vehicle wash racks, defueling station, and other such facilities as discussed in Chapter 2. Node AS16 defines Attribute 11 as the time remaining in the assembly area by subtracting the required time in the marshalling area (placed in XX(9) by Subroutine INTLC) from the time remaining before departure. Attribute 11 becomes the duration of activity 24. Following this, node AS17 subtracts the tonnage from each class in the assembly area. It is then routed directly to the marshalling area.

The marshalling or chalks area (Figure 16) is represented by nodes AS18 and AS19. These nodes function identically to AS15 and AS17, first adding the tonnage into the area, then subtracting it out. The time in the area is

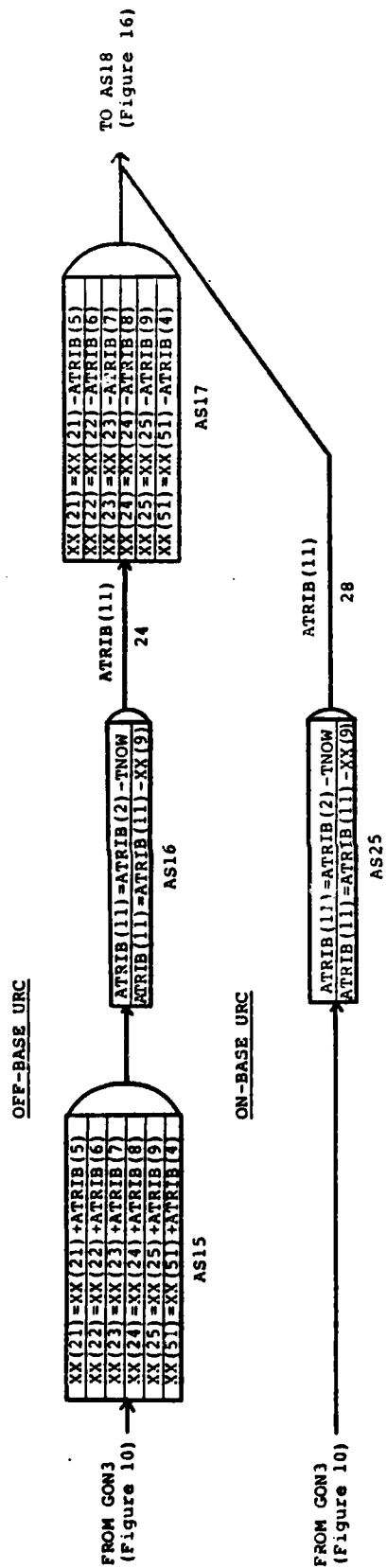


Figure 15: Unit Assembly Area

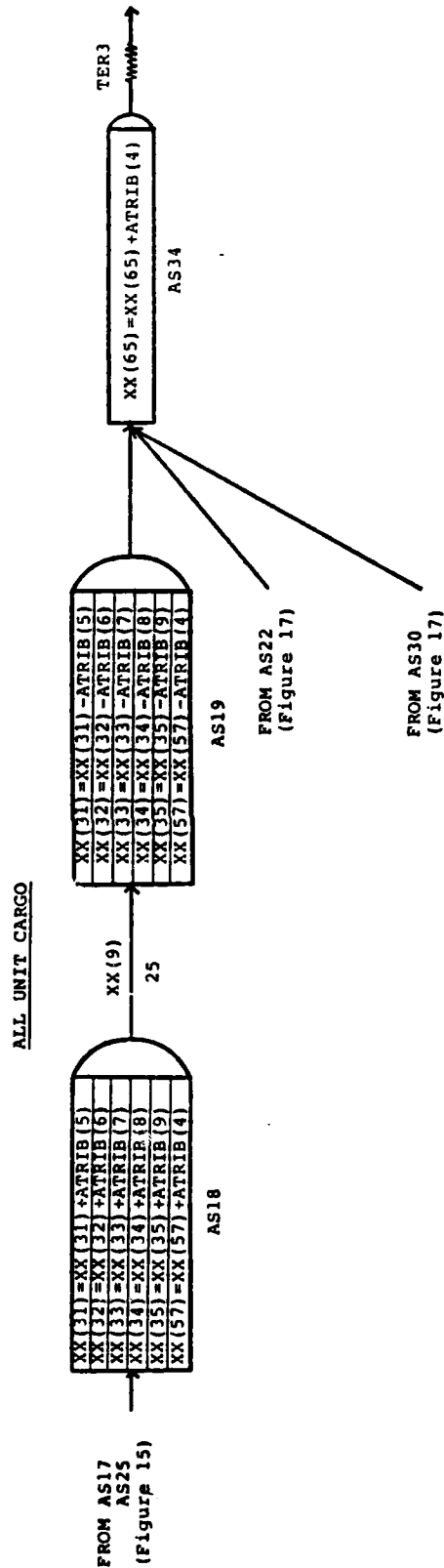


Figure 16: Marshalling (Chalks) Area

set by activity 25, with a duration of XX(9). Once removed from the area, the cargo is routed to node AS34, where it is added to the daily departure total; and then to TER3, where the entity is destroyed as it departs the system.

On-base unit-related cargo (Type 4) enters the system from the owning unit's assembly area, which is not included in the reception system. The model replicates this with node AS25 and activity 28 (Figure 15). This causes a delay for the cargo representing the time between when it is ready for movement and when it is actually called forward into the marshalling (chalks) area. After that delay, it is routed to node AS18, where it is added into the marshalling area.

Off-base nonunit-related cargo (Type 3) is routed to node AS20, where it is added to the total in the air cargo terminal (Figure 17). Because this cargo must first be received and processed by the Surface Freight Section of the base transportation function (10), node AS20 adds the total figure to both the total off-base cargo and total (on- and off-base) cargo in the terminal. In this way, the managers can get an idea of the amount of off-base cargo the Surface Freight Section will have to process. Node AS21 defines the time remaining before departure, which is the duration of activity 26. Following this, node AS22 subtracts the cargo from this area, and it is routed to

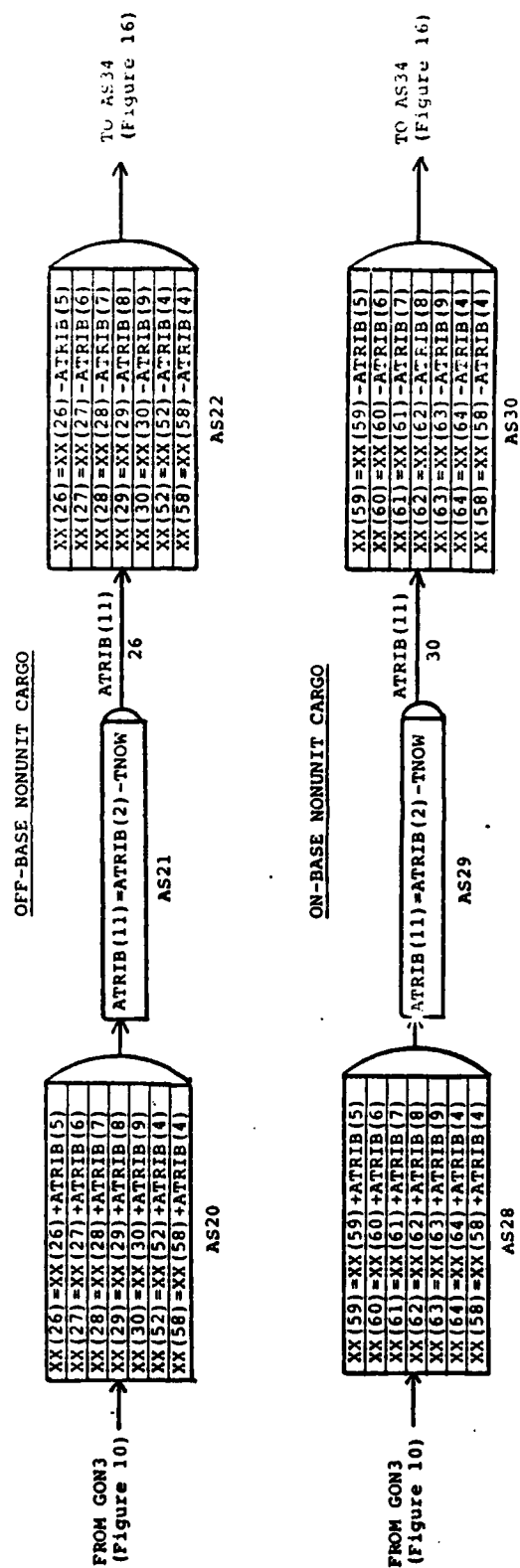


Figure 17: Air Cargo Terminal

node AS34 where it is added to the daily departure total and destroyed.

On-base nonunit-related cargo (Type 5) is routed to node AS28 (Figure 17), where it is processed in a manner similar to the off-base nonunit cargo. The figures for on-base nonunit cargo are tracked separately from the off-base nonunit cargo, with the exception of the overall total. Again, the time remaining before departure is calculated. Once this time has elapsed, the cargo is subtracted out of the area and routed to node AS34.

A separate timing network, shown in Figure 18, is used to re-zero the daily departure totals every 24 hours.

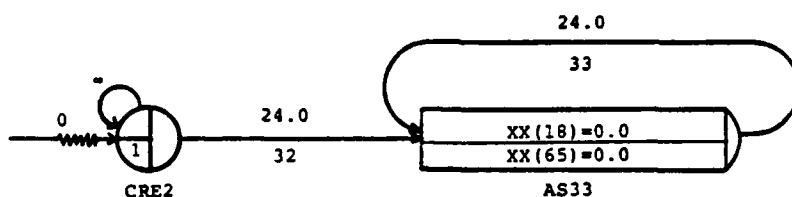


Figure 18: Timing Loop

PHASE I OUTPUT PRODUCTS

The output of the Phase I model consists of the standard SLAM summary report and a series of plots. The summary report provides a great deal of information, much of which is of little interest in this particular application. The 'Echo Report,' however, which lists the parameters and options specified by the user, is useful as a check

on the input in the event that the model does not function as intended.

The six plots which follow the echo report are the primary output in this application. Each plot shows the population or tonnage figures in different areas of the system over time. The plots are established by use of 'RECORD' and 'VAR' statements in the SLAM input. These statements, along with the entire SLAM program, appear in Appendix 2. Comments embedded in the SLAM input explain the contents of each plot. Therefore, that information will not be repeated here. At the user's discretion, the same data could be presented in tabular form.

In setting up the plots, the user has a great deal of flexibility in defining both vertical and horizontal axes. The independent variable, time, appears on the horizontal axis (actually, along the length of the computer paper). The user can specify both the increment used (how often to plot the points) and the starting and stopping times. The dependent variables, which are the population and tonnage figures, appear on the vertical axis (across the width of the paper). For these, the user can specify the scale of the axis in several ways, and also the symbol to be associated with each variable. Figure 19 shows a sample of the plot output.

VALIDATION AND VERIFICATION OF THE PHASE I MODEL

Following construction and initial computerization of the Phase I model, it was validated and verified. Validation consists of insuring that the model accurately reflects the system being modelled. In the case of Phase I, this was accomplished by discussing the model with personnel at Headquarters AFLC (12; 13; 24) and at the 2750 Air Base Wing (1; 7; 10; 17). Because the Phase I model is by nature very general, the validation was primarily a matter of insuring that the sorting and routing of the FRNs were proper, and that the TPFDD data were interpreted correctly.

Verification is the process of insuring that the model is functioning as intended. This was accomplished by using imbedded trace statements in the user-written subroutines and the built-in SLAM trace capabilities. These were activated, and several FRNs were followed through the discrete and network portions of the model. As expected, several bugs were discovered and rectified. It should be noted that verification extended to only those areas for which the modeller was responsible. It was assumed that the internal workings of the SLAM processor, as well as the random number generators, functioned properly.

As an aid to future users of this model, Appendix F contains a summary of the steps necessary to prepare and

run the Phase I model.

CHAPTER SUMMARY

This chapter has dealt in depth with the computerization of the Phase I model. Beginning with an introduction to SLAM II, the chapter explained the inner workings of the model, including both the user-written discrete event portion and the network portion. Within the discrete event portion, the attribute assignment logic was explained, as was the procedure for filing and retrieving the FRNs. The validation and verification of the model was discussed. A procedural summary for future users, which was developed in conjunction with the computerization, is included in Appendix F. The next chapter will discuss the development and computerization of the Phase II model.

CHAPTER 4

PHASE II COMPUTERIZATION

INTRODUCTION

The preceding chapters outlined a methodology for reception planning which involves several sequential steps. First, the Phase I model is to be run with data drawn from the appropriate TPFDD and other sources. Next, the information produced by the Phase I model is to be used by the managers to develop a tentative reception plan. This plan is then to be computerized as the Phase II model. Finally, the plan is to be tested by exercising the Phase II model under various conditions as reflected in the initialization parameters.

The original intent of this thesis was to use the complete methodology with Wright-Patterson AFB as a test base. Midway through the research, however, it became apparent that time would not permit this strategy. Therefore, rather than developing a detailed Phase II model of the Wright-Patterson reception plan, it was decided that the model should be developed in such a way that the managers could fill in the resource levels and parameters at some future date.

As a result of this decision, the Phase II model described in this chapter is more complex than originally

conceived, since it must be able to accommodate a number of alternative processes. However, an unexpected benefit of this change in strategy is that the resulting Phase II model can be much more easily transferred among APOEs than was originally expected.

This chapter will detail the construction of the Phase II model. The first section will explain the TPFDD input data preparation, initialization of the XX(.) array, and validation of the user-written subroutines. These subroutines include EVENT, USERF and ALLOC. The discussion of ALLOC will explain the different resource allocation strategies used in various areas of the system. The next section will discuss the Phase II network, considering first the passenger subnetwork, and then the cargo subnetwork.

INPUT DATA PREPARATION

The data which drive the Phase II model are essentially identical to the data used for Phase I. In Chapter 3, the procedures used to read in the TPFDD data and compute the attributes were discussed in detail. In most applications of the model, the input data will come from three sources. Two of those will be magnetic tapes. One will include the force records (unit-related cargo and personnel) and the other the nonunit-related cargo and personnel. The third source will be a card deck containing the mobilization augmentee information. The procedures established for the

input which were used in this thesis are shown in Appendix D, and are specific to the computer resources at Wright-Patterson AFB. They may require modification if used elsewhere.

VARIABLE INITIALIZATION-SUBROUTINE INTLC

The use of the XX(.) array was introduced in Chapter 3. Phase II makes extensive use of this array as a means of establishing activity durations, management policies, and event probabilities. This use of the XX(.) array is one of the primary means of maintaining flexibility in the model. With this array, users can specify a duration, policy, or probability without modifying the internal structure of the model. Potential options will be discussed in later sections of this chapter. Table 1 (Appendix C) lists all XX(.) variables used in both Phase I and II models, along with their definitions.

VALIDATION OF THE USER-WRITTEN SUBROUTINES

In addition to Subroutine INTLC there are three other user-written subroutines which must be validated and potentially modified before each use of the model. These are Subroutines EVENT and ALLOC, and Function USERF. Like INTLC, these are a major source of flexibility in the model. In several places, the user-written subroutines are also a means of modelling events which are too complicated to be handled by the standard network procedures

available with SLAM II.

The coding for each of these subroutines and functions is included in Appendix D. Since comments embedded in the code explain the function of each, that information will not be repeated here. For purposes of verification of the model, it was necessary to assign activity durations, management policies, and event probabilities throughout the subroutines which are not based on any real situation. Therefore, the model which is presented in Appendix D is a model of the 'Base X' reception plan in the literal sense of the term. It is the responsibility of the users of this model to review each of the subroutines and make the necessary changes. Once that is done, the model will then be tailored to their plan.

RESOURCE ALLOCATION IN SLAM

A major feature of the Phase II model is its allocation of resources. Throughout the reception system, demands are placed for different resources. As introduced in Chapter 1, the purpose of this model is to show the managers whether or not their system can accommodate those demands. SLAM offers extremely powerful tools to accomplish this task.

Resources in SLAM are defined by statements which appear at the beginning of the network input (see the Phase II coding, Appendix D). Each resource is given a

label which may be up to eight alphanumeric characters, beginning with an alpha. This label is one way of referring to the resource, and is used for network-controlled allocation. Additionally, each resource is assigned a number by the SLAM processor which corresponds to its position in the list of resources. This number is the means of referring to the resource from any of the user-written subroutines. For this reason, the order established in this model must not be altered in any way without also making corresponding changes to the user-written subroutines. Each resource is also characterized by the number of units available, and by file numbers. The file numbers reference the internal files where the FRNs will be held while awaiting the resource. There may be several resources associated with a single file, or several files associated with a single resource.

Within the reception system, there are several categories of resources and several different methods of allocating them. One way of categorizing resources is to define them as either essential or nonessential. Essential resources are those which are required for timely departure from the system (for instance, passenger agents or joint inspection teams). Nonessential resources are those which are desired but not required for timely departure. As an example, if the feeding capability of the APOE is exceeded, the system may not be meeting its goals but the departures will not be delayed.

Another decision which impacts on the allocation logic is whether the FRN is to be kept as a single group following the allocation or split into smaller groups. In the discussion of the network, the strategy chosen for each case will be identified.

A final factor which must be considered involves the prioritization of the FRNs waiting in each file for a resource, and the prioritization of multiple files waiting for the same resource. Throughout the model, it is assumed that priority will be given to those FRNs with the most imminent departure times. Therefore, priority within each file is given to the FRN with the lowest value of Attribute 2, the scheduled departure time. When more than one file is waiting for the same resource, priority is given to the file closest to the departure point. For instance, it is considered more important to allocate a bus to transport passengers to a waiting aircraft than to transport other passengers to the billeting area.

THE PHASE II MODEL

This section will discuss in detail the structure of the Phase II model. It will follow the same pattern used in Chapter 3, starting with the initial discrete event portion, followed in turn by the passenger and cargo subnetworks.

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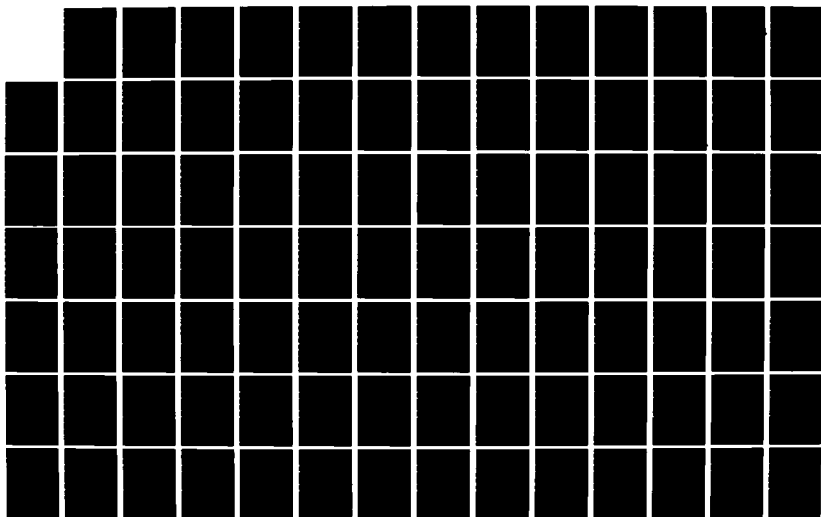
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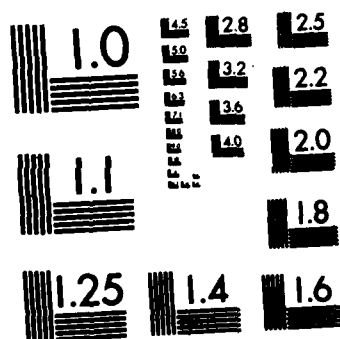
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

THE DISCRETE EVENT PORTION

As shown in Figure 20, the structure of the initial discrete event portion of Phase II is identical to that used in Phase I. However, Phase II encounters some limitations not met by Phase I. The Phase I model used only 11 attributes per FRN, while the Phase II model uses 18. Because of this, a large war plan could possibly exceed the storage capacity available within the simulation. Therefore, EVENT (1) was rewritten to not only read the data directly from tape (as discussed in Chapter 3 and Appendix D) but also to utilize external file storage instead of File 1 for the future arrival file.

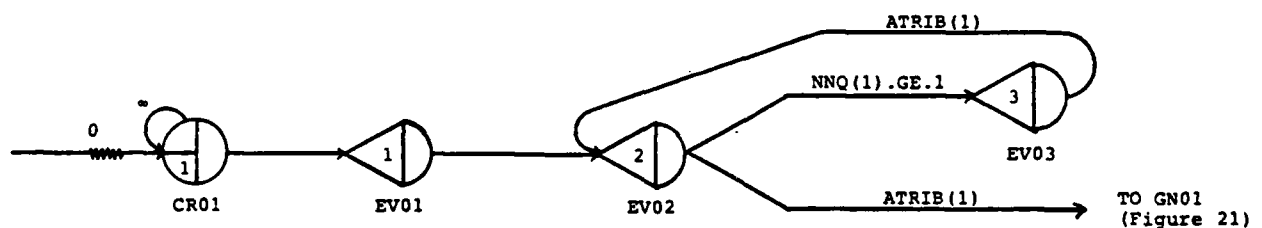


Figure 20: Initial Processes, Phase II Model

In the demonstration used in this thesis, the number of FRNs should not initially exceed the internal storage capabilities. Any problem would more likely occur after the simulation has started, when the possibility exists that a single FRN may be split into several smaller groups. If this occurs before enough FRNs have processed through and departed the system, the simulation will abort.

The approach used in this thesis takes advantage of the initial capability to accommodate the entire workload in File 1, but empties File 1 into an external file before the start of the simulation. In this manner, the need to create a sorting routine was eliminated, since File 1 can be sorted by the SLAM prioritization routine. EVENT(2) was rewritten to periodically read in a small number of the future arrivals from the external file, placing them into File 1. They are then removed from File 1 at their arrival times by the EVENT(2) - EVENT(3) cycle as discussed in Chapter 3.

The remainder of the discrete event portion of the model, consisting of the attribute computation and assignment, is essentially identical to that used for Phase I. Minor differences include modifications to the calculation of arrival and departure times, which were discussed in Chapter 3, and the inclusion of Attributes 12 through 18, which are all initially set to zero.

Also nearly identical to Phase I is the initial cargo/passenger sorting, shown in Figure 21. The first sort is made at node GN01, which sends FRNs with passengers to node GN02 and those with cargo to node GN05. Any FRN with both passengers and cargo is split, with a duplicate sent each way. Node GN02 is the initial point in the passenger subnetwork, while node GN05 is the initial point in the cargo subnetwork. At GN02, the passengers are sorted

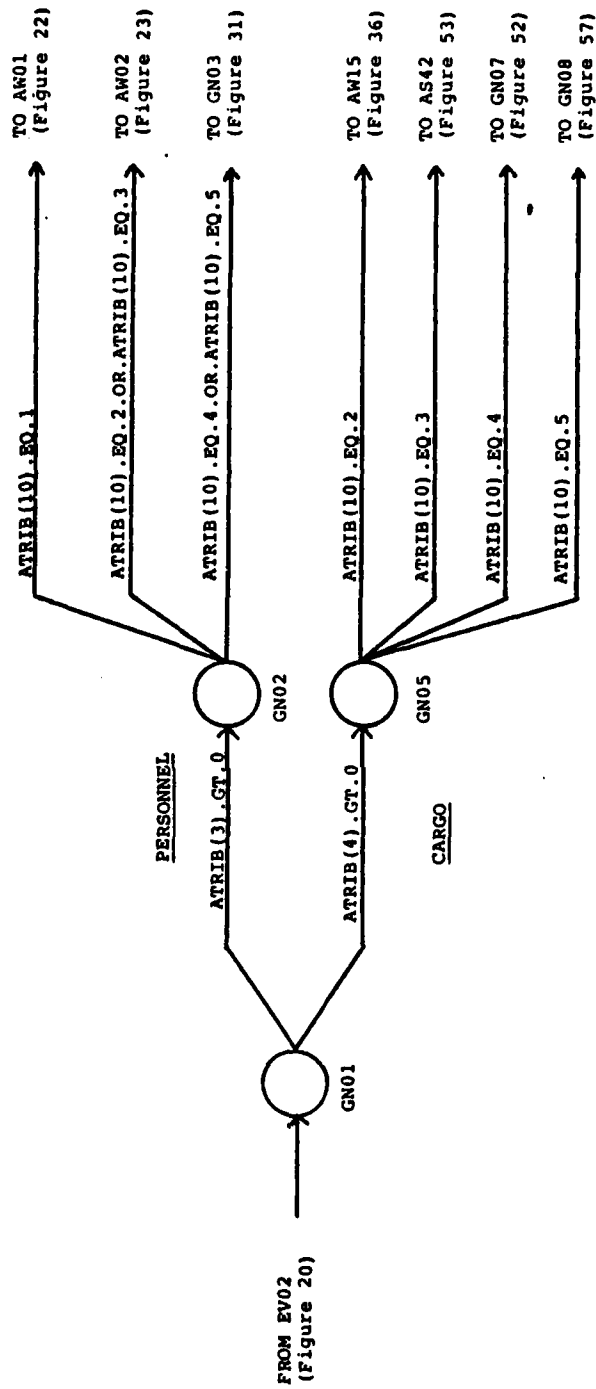


Figure 21: Phase II Cargo/Passenger Sorting

by type (Attribute 10). Nondeployers (type 1) are sent to node AW01, representing permanent billeting. Off-base deploying FRNs (types 2 and 3) are sent to node AW02, the reception point; and on-base deploying FRNs (types 4 and 5) are sent to node GN03, where they prepare for movement to the staging area.

The branching from node GN05 also sorts the cargo by type. Off-base URC (type 2) is sent to node AW15, the cargo reception point. Off-base NRC (type 3) is sent to node AS42, where it enters the NRC processing system. On-base URC (type 4) is sent to node GN07, where it is further sorted and entered into the system at the correct time. Likewise, on-base NRC (type 5) is sent to node GN08, which performs the same function.

THE PASSENGER SUBNETWORK

The following sections will discuss the passenger and cargo subnetworks. Within these subnetworks, there are a few sequences which are replicated in several places. Such sequences will be described in detail the first time they are encountered, and merely identified in subsequent encounters. Later sections will discuss the output products.

NONDEPLOYING PERSONNEL BILLETING

Arriving from node GN02, nondeploying FRNs (type 1)

enter Await node AW01, shown in Figure 22. This node effects a network-controlled allocation of resource NODEPBIL, which is permanent billeting for the nondeploying FRNs, with one unit being defined as billeting space for one person. Each FRN is given Atrib(3) units of the resource, with Atrib(3) being the number of persons in the FRN. Should there be insufficient billeting available, the arriving FRN will be held in File 2 until such time as more resource becomes available. Once the allocation is complete, the FRN is sent to node TR01, where it is eliminated from the system.

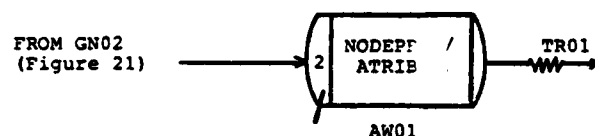


Figure 22: Non-Deploying Personnel Billeting

OFF-BASE PERSONNEL RECEPTION POINT

Off-base deploying personnel (both unit-related and nonunit-related) are sent to Await node AW02 (Figure 23). This node effects a network-controlled allocation of resource RECPOINT, which is space in the reception point with one unit being space for one person. Each arriving FRN is given Atrib(3) units of RECPOINT if available; if not, the entire FRN waits in File 3.

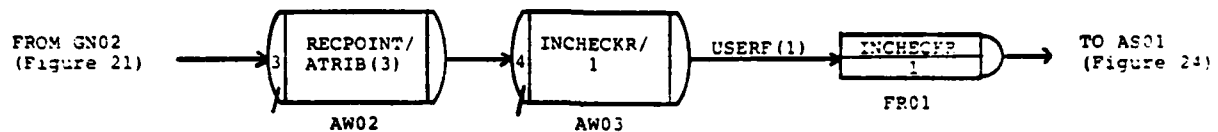


Figure 23: Reception Point

Once the allocation is complete, the FRN proceeds to node AW03, which effects a network-controlled allocation of the resource INCHECKR (defined as the individual or team responsible for processing the FRN into the APOE). Each FRN is given one unit of INCHECKR. If no units of INCHECKR are available, the FRN waits in File 4. Both RECPOINT and INCHECKR are considered essential resources. Therefore, the FRNs cannot proceed until they have been allocated the appropriate amounts of each.

When the FRN has been allocated a unit of INCHECKR, it is allowed to proceed along the activity to node FR01. This activity has a duration which is computed by Function USERF(1) for each FRN passing this way. The duration of the activity reflects the time spent inprocessing. (Detailed comments for this, and all other user-written subroutines, may be found in the coding which appears in Appendix D.) After this time has elapsed, the FRN reaches FR01, where the INCHECKR is 'freed' or made available to process additional FRNs.

ROUTING OUT OF THE RECEPTION POINT

At this time, the FRN's scheduled departure time is checked by node AS01 (Figure 24). This node calculates the time remaining until departure, setting Atrib(11) equal to USERF(2). This function takes into account several factors, and if the FRN is behind schedule a message is printed to that effect. AS01 also calculates the number of busloads in this FRN in case bus transportation is needed to the staging area. This number is calculated by USERF(11) and placed in Atrib(17).

Two of the XX(.) variables are used to determine the branch to be taken from AS01. XX(8) is the minimum time remaining which would justify billeting the FRN. XX(41) is the type of transport from the reception point to the staging area. If the time remaining (Atrib(11)) is less than XX(8) and XX(41) indicates that they are to walk to the staging area, the FRN is routed to node FR23, where it leaves the reception point and frees the RECPOINT it was given. It then moves to the staging area on foot. XX(42) reflects the transit time to the staging area. Therefore, the FRN will arrive at node AW08 (which is the staging area) XX(42) hours later.

If, on the other hand, XX(41) indicated that buses would be provided for the move to the staging area, the FRN takes the branch leading to node AW13, which will allocate buses (resource BUS) to it. The RECPOINT is not freed yet,

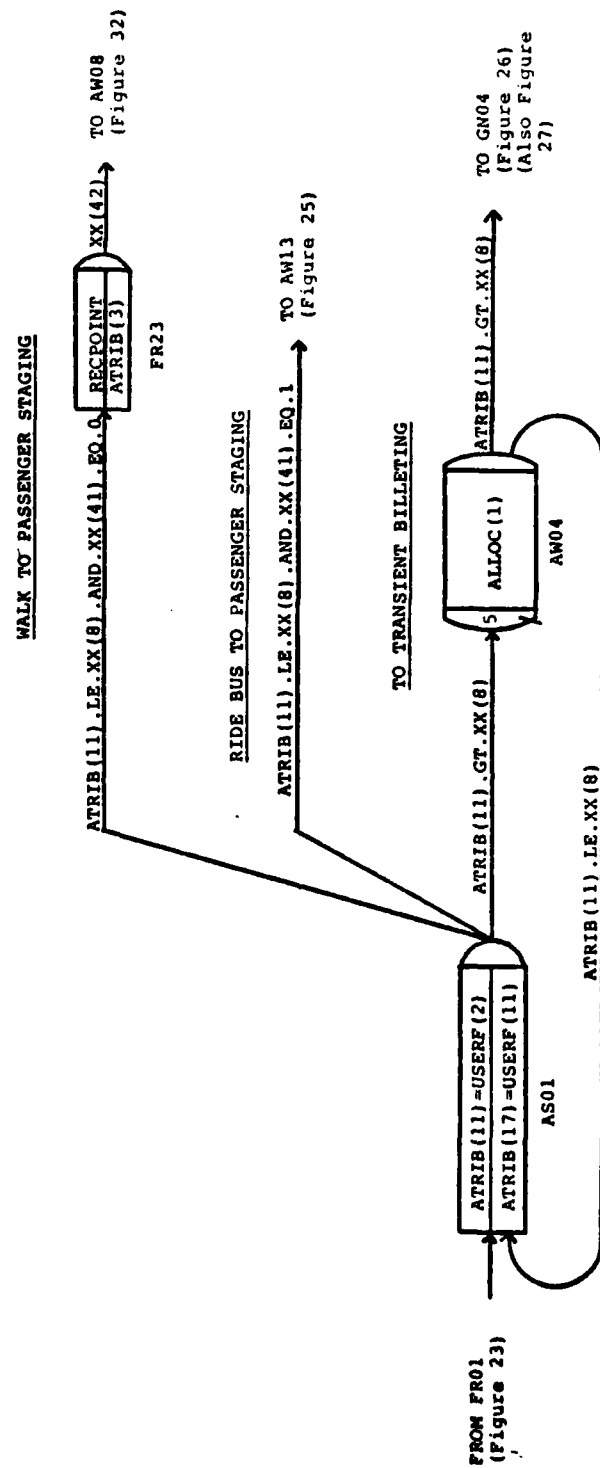


Figure 24: Routing Out of Reception Point

since there may be a delay before buses become available.

As the last alternative, if the time before departure is sufficient to warrant billeting this FRN, it is sent to node AW04 which attempts to allocate space in the transient billeting area(s). The model has the potential for up to five billeting areas. They are labelled TRABIL1, TRABIL2, TRABIL3, TRABIL4, and TRABIL5, in decreasing order of preference. Should the managers not want to establish five areas, the unused areas, which should be the last ones listed, need only be established as having no units available. It is emphasized once again that even if one of these resources is not used, it must be left in the input list to maintain the internal numbering consistency of the other resources.

The allocation of transient billeting cannot be handled by network-controlled procedures. Therefore, the logic is coded into Subroutine ALLOC(1). The subroutine first recalculates the time remaining to departure, on the chance that an FRN might have been waiting for billeting to become available so long that the allocation is no longer justified. In such a case, the FRN is released from the node and branches back to node AS01, where it is sent to the staging area. The logic next attempts to billet the entire FRN in a single area, giving priority to the lower-numbered areas. Failing that, it will try to billet the FRN in as few separate areas as possible. If there are not enough

vacancies to accommodate the entire FRN, it will be held in File 5.

If the allocation was successful, the FRN will carry with it the number of units of each area it was given. This will be found as Attributes 12 through 16, which correspond to the resource numbers for the five billeting areas. The FRN is then routed to node GN04. This discussion now returns to the FRNs which are awaiting bus transportation to the staging area.

BUS ROUTING, RECEPTION POINT TO PASSENGER STAGING

When FRNs arrive at node AW13, which allocates buses (Figure 25), they carry with them Atrib(17) which has been defined at AS01 as the number of busloads in each group. Transportation is considered to be an essential resource. The allocation of buses is too complex to be handled by network procedures, so it is coded as Subroutine ALLOC(2). The logic keys on the number of buses needed, as shown in Atrib(17), and the number of buses available. By way of illustration, consider the case where an FRN consisting of 120 persons (three busloads) arrives at AW13 when only two

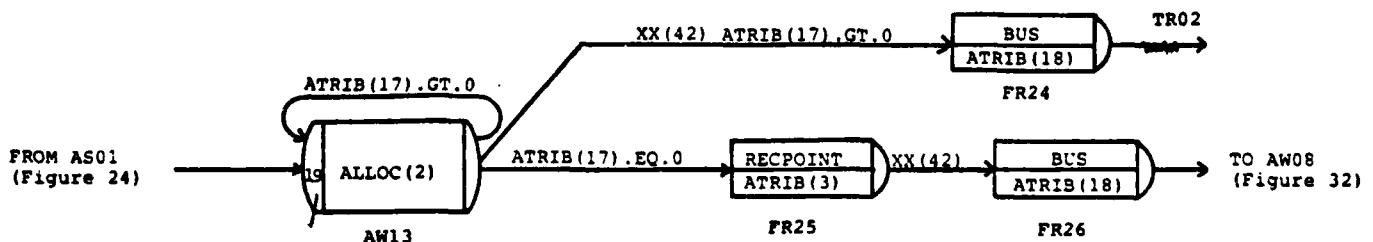


Figure 25: Bus Routing, Reception Point to Passenger Staging

buses are available. The two buses would be allocated. Atrib(17) would be decremented by two (to one), reflecting the number of busloads still awaiting transportation. Atrib(18) would be incremented to two, reflecting the number of buses currently in use by this FRN. The FRN would be allowed to proceed. However, since Atrib(17) is greater than zero, two copies would be released from AW13. One would be routed directly back to AW13, reflecting the one busload left. The other would be routed to node FR24, with a duration of XX(42). Once this time (which is the transit time to the staging area) has elapsed, the buses are freed by FR24. The two busloads are then destroyed by node TR02. One of the freed buses is then allocated to the single busload waiting at AW13. Its Atrib(17) is decremented to zero, its Atrib(18) is incremented to 1, and it is allowed to proceed. This time, however, since its Atrib(17) is zero it will take the branch to node FR25.

This FRN, though it is only one busload out of three, carries with it all the attributes of the entire group. Therefore, at node FR25, it will free 120 units of RECPOINT. At this point, it has left the reception point and is en route to the staging area. After XX(42) hours have passed, the one bus still in use will be freed by node FR26, and the FRN will enter node AW08, which is the staging area. This bus allocation logic will be replicated in several areas of the passenger subnetwork. The discussion

will merely reference this section. The flow of the discussion now returns to the FRNs which were allocated billeting space.

ROUTING FROM THE RECEPTION POINT TO TRANSIENT BILLETING

For each of the five potential billeting areas, the managers can specify if bus transportation will be allocated to take FRNs to that area, and also if buses will be allocated for the trip from that area to passenger staging. As discussed above, all FRNs going to the billeting area(s) are routed to node GN04. As shown in Figures 26 and 27, the FRN is split if necessary and sorted according to the area(s) it has been allocated and the transportation mode to those areas. Figure 26 shows the routing taken if the mode for a particular area is by bus, while Figure 27 shows the routing if by foot.

In Figure 26, each of the branches leads to an ASSIGN node. Since an FRN assigned to two different areas must from this point on be treated as two different FRNs, these ASSIGN nodes allow the future identification of the FRN and its size by zeroing out the attributes reflecting parts of the original FRN in any of the other billeting areas. Additionally, the ASSIGN nodes recompute the number of buses needed for each group going to a separate billeting area. They then are routed to node AW05, where they await bus transportation.

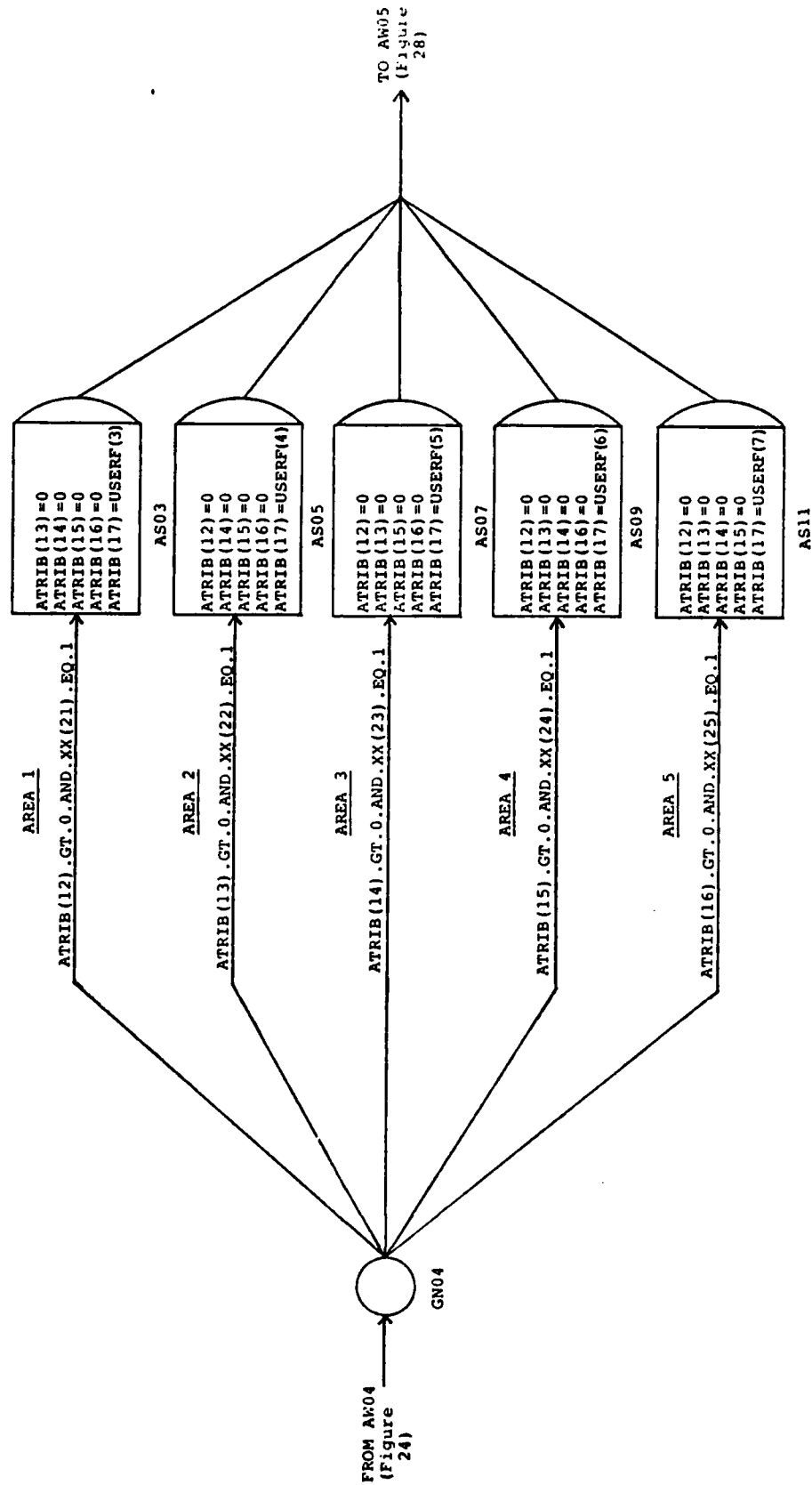


Figure 26: Bus Routing to Transient Billeting

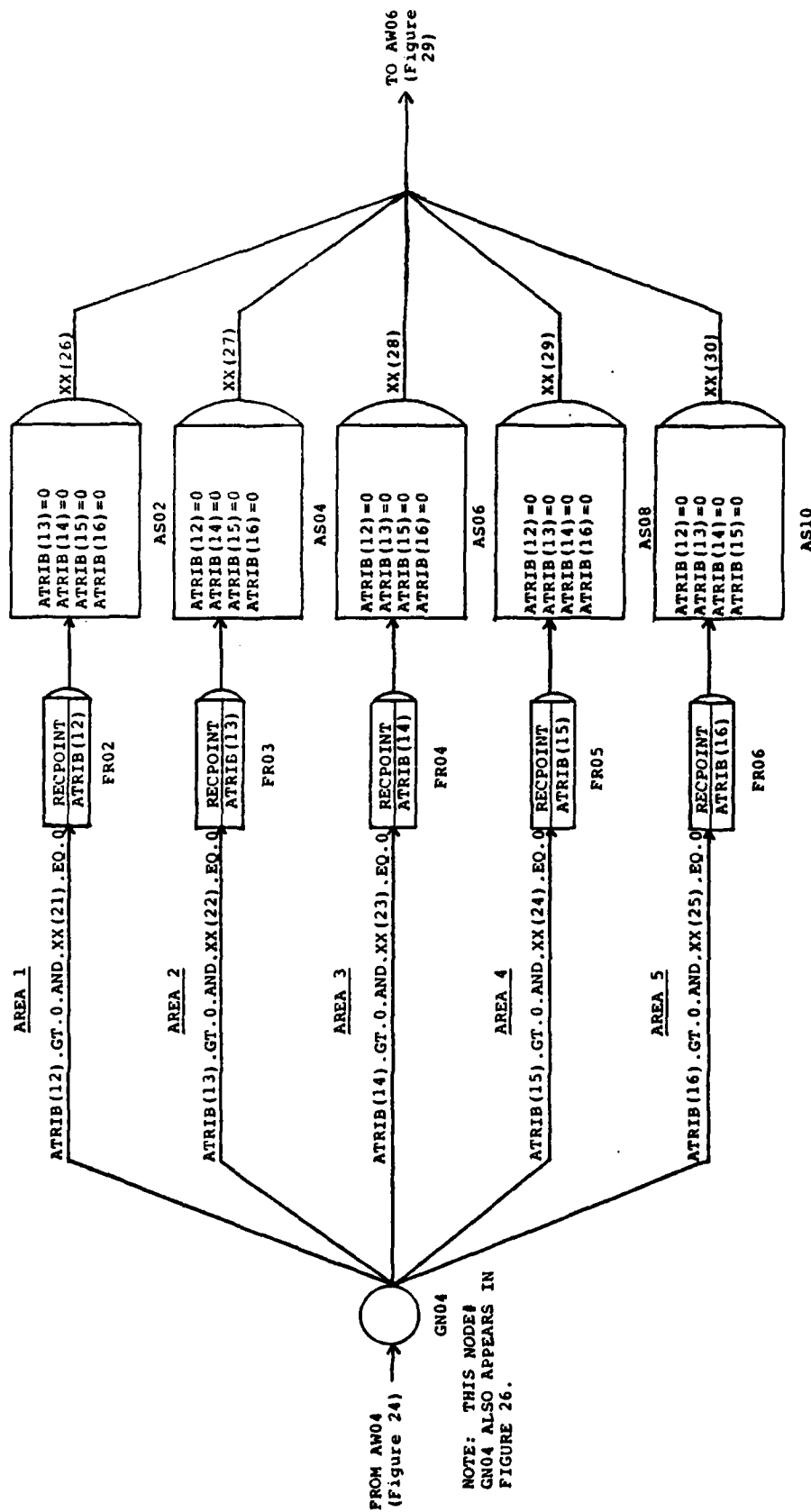


Figure 27: Pedestrian Routing to Transient Billeting

In Figure 27, the same type of sorting occurs for any group which is to walk to its assigned area. They first encounter a FREE node, which frees a number of units of RECPOINT equal to the size of this group. They next encounter an ASSIGN node, which zeros out the attributes reflecting parts of the original FRN in any other billeting area. They then are routed to node AW06, which represents their arrival into the appropriate area(s). The time until that arrival is defined by the user in the XX(.) array as XX(26) through XX(30).

Any FRN sent to AW05 (Figure 28) will wait there for bus transportation. The logic used is identical to that discussed earlier, with the exception that the transit time must be determined by USERF(13), since the destination must first be determined; and the RECPOINT is freed by Subroutine EVENT(4), since the number of people in this group also must first be determined. Following the transportation, the FRN(s) will arrive at AW06, representing their arrival at the billeting area(s).

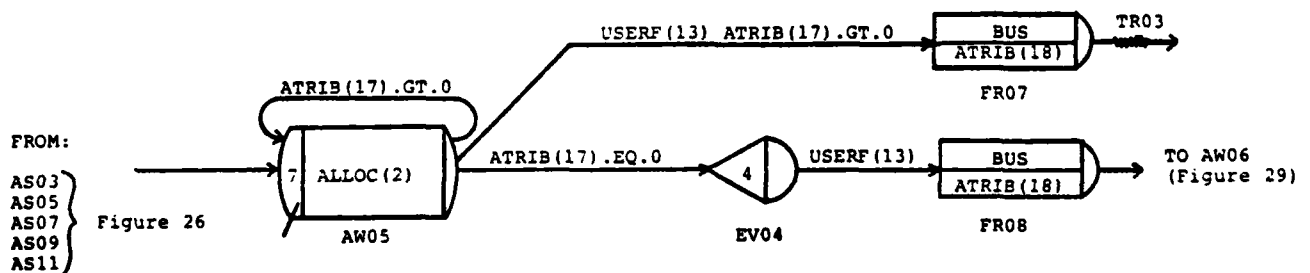


Figure 28: Bus Routing, Reception Point to Transient Billeting

TRANSIENT BILLETING AREAS AND ROUTING TO PASSENGER STAGING

Upon arrival to AW06 (Figure 29), which represents entry into the appropriate billeting area, the FRN is allocated feeding resources according to the area to which it is assigned. Because feeding is considered nonessential according to the definition given earlier, and because the logic must first determine which area the FRN is assigned to, the allocation is handled by Subroutine ALLOC(3). Each area has its own feeding resource, labelled BIL1FEED through BIL5FEED. The quantities available will be for each area, although a single facility may serve more than one area. In such a case, the total capacity of the facility should be divided among the areas. Further comments on this subject are embedded in ALLOC(3), which appears in Appendix D.

Should insufficient feeding resource be available, a notice is printed to that effect, and the FRN is allowed to proceed to node EV05. The duration of that activity is defined by USERF(8), which calculates the time remaining in transient billeting. Once that time has elapsed, the FRN arrives at EV05, which causes a call to Subroutine EVENT(5). This frees whatever feeding resources were allocated, and recalculates the number of buses that this group needs. The branching from node EV05 incorporates a feature not encountered previously in this model, reflected by the '1' in the right-hand side of the node. This indicates that a maximum of one entity is to be released from the node.

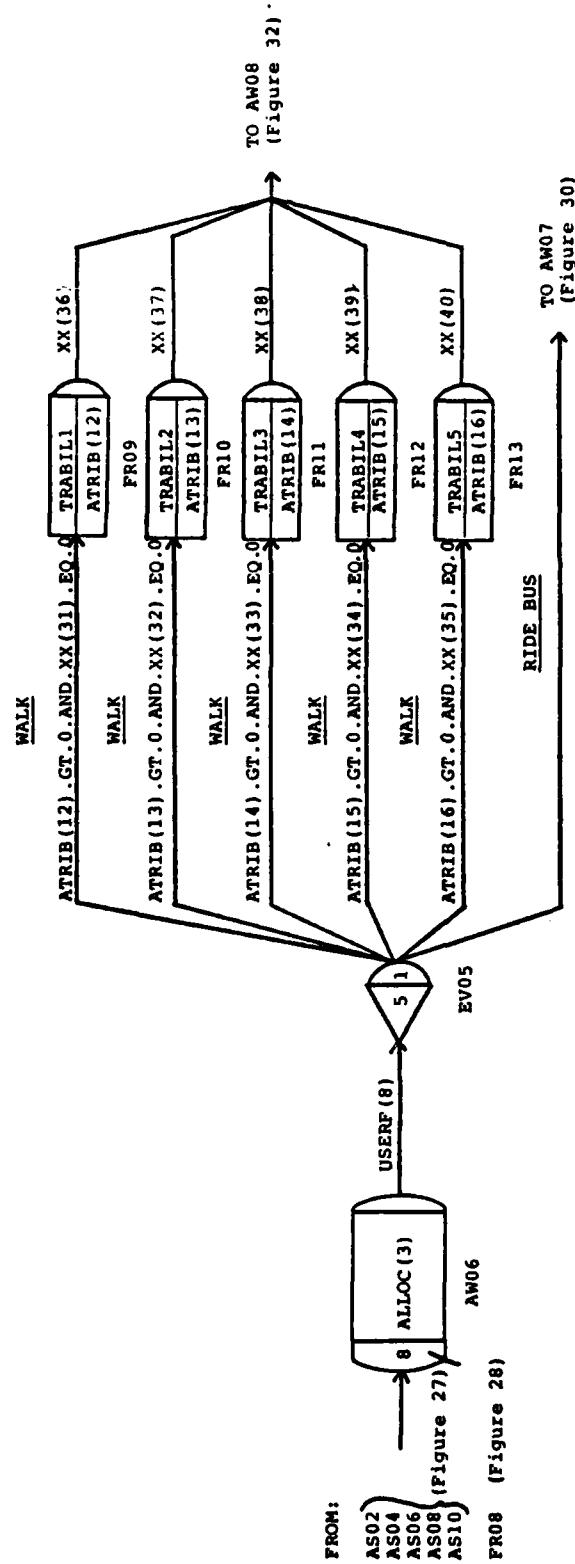


Figure 29: Transient Billeting Areas and Routing to Passenger Staging

The SLAM logic will consider each branch in turn from top to bottom, looking for the first branch which the entity could take. The first five branches reflect the option of having the FRN walk to passenger staging from a given area. For instance, if the FRN at EV05 was assigned to area 3 and the managers defined the mode from area 3 to the staging area as walking, the conditions for the third branch would be satisfied and the FRN would be sent to node FR11. At that node, the units of TRABIL3 held by the FRN would be freed, and it would be sent to node AW08 (which allocates the passenger staging area), with a time to arrival of XX(38).

If, on the other hand, the mode from area 3 to the staging area had been defined as by bus, none of the first five branches would be acceptable. Therefore, the FRN would be routed over the sixth branch (which has no conditional specification) to node AW07, where it will await bus transportation.

BUS ROUTING, TRANSIENT BILLETING TO PASSENGER STAGING

Upon arrival to node AW07 (Figure 30), the FRNs enter into a bus allocation logic identical to that used previously in the bus routing from the reception point to the transient billeting areas. At this point, the activity duration is determined by USERF(14) and the billeting areas are freed by EVENT(6).

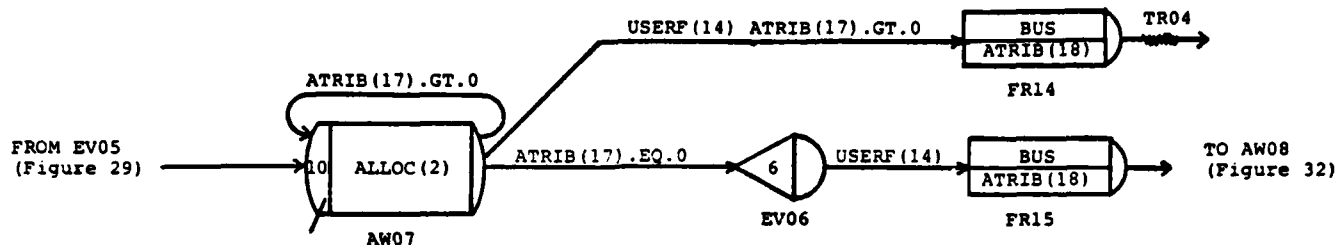


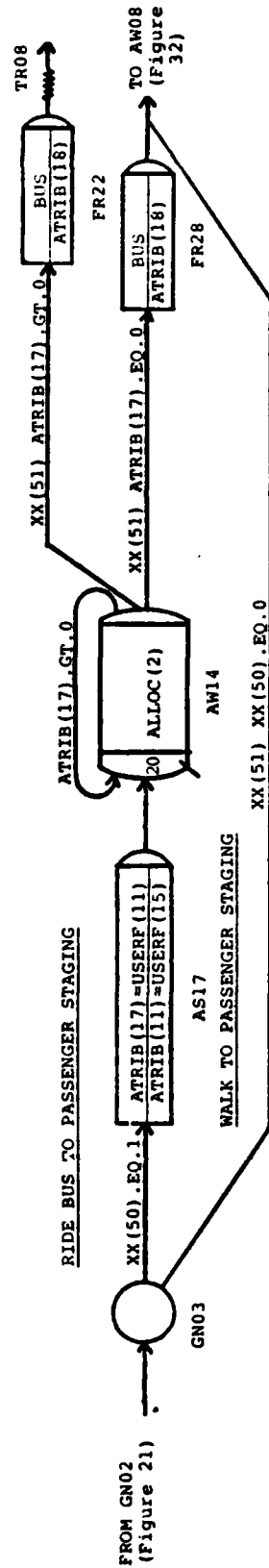
Figure 30: Bus Routing, Transient Billeting to Passenger Staging

MOBILITY LINE TO PASSENGER STAGING ROUTING

On-base deploying personnel are processed through the mobility line, which is outside of the reception system. As shown in Figure 31, the managers can specify either bus transport or walking as the mode from the mobility line to the passenger staging area. Should they specify walking, the FRN is routed directly to AW08, with a time to arrival of XX(51). Should they specify bus allocation, the FRN is routed to node AS17, where the number of busloads is calculated. It is then sent to AW14, which uses the same bus allocation logic previously discussed. The transit duration is XX(51). After all busloads are transported, the FRN enters AW08, the passenger staging area.

PASSENGER STAGING AREA

The passenger staging area, shown in Figure 32, receives FRNs from the several routes previously discussed. When they arrive, they enter node AW08, where space in the staging area (resource PAXSTG) is allocated. Also at this node, feeding capability (resource PAXSTGFD) is allocated



**Figure 31: Mobility Line to Passenger Staging Routing
(On-Base Deploying Personnel)**

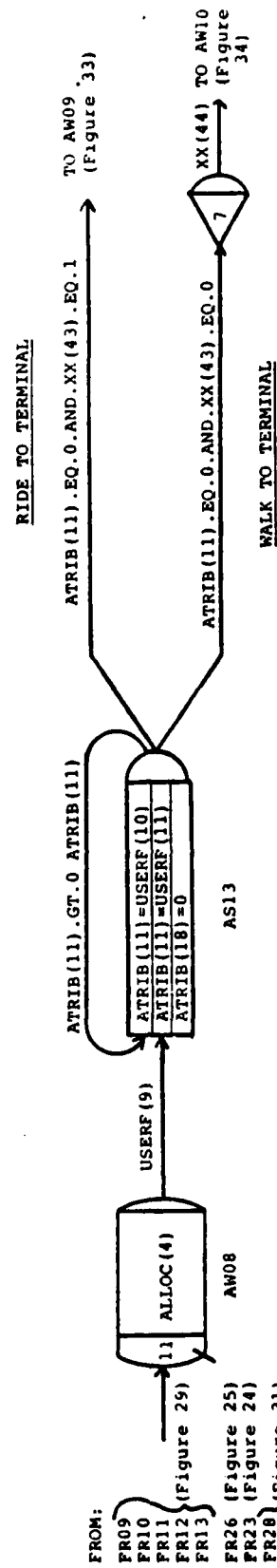


Figure 32: Passenger Staging Area

if it is available. While the space is considered an essential resource, the feeding is considered nonessential. Therefore, the allocation is handled by Subroutine ALLOC(4). If there is not sufficient space for the entire group in the staging area, it will be held in File 11 until enough becomes available. Should enough space be available but not enough feeding, the space and what feeding is available will be allocated. A message will be printed identifying the shortfall, and the FRN will be allowed to proceed.

Following the allocation, the FRN is routed to node AS13, with a time to arrival defined by USERF(9). This reflects the time needed for processing in the passenger staging area. At node AS13, the time remaining before the FRN should move to the passenger terminal is defined by USERF(10) and placed in Atrib(11); the number of busloads in this group is defined by USERF(11) and placed in Atrib(17); and Atrib(18), which will reflect the number of buses allocated, is set to zero.

Three routes are possible from node AS13. If the time remaining before the move to the terminal is greater than zero, the FRN is routed back to AS13, with a duration of Atrib(11). This reflects a simple holding action in the staging area. If the time remaining is zero, the FRN is routed to either node AW09 (where it awaits bus transportation) or node EV08. At node EV08, the staging area space and feeding resources are freed, and the FRN then is routed

to node AW10 by foot, with a duration of XX(44).

BUS ROUTING, PASSENGER STAGING TO PASSENGER TERMINAL

If the managers specified bus transportation from passenger staging to the terminal, the branch to node AW09 will be taken. AW09 (Figure 33) initiates the same bus allocation routine seen several times previously. The transit duration here is XX(44), and EV07 frees the staging area space and feeding resources held by the FRN as it passes. When all of the group has been transported, it is routed to node AW10.

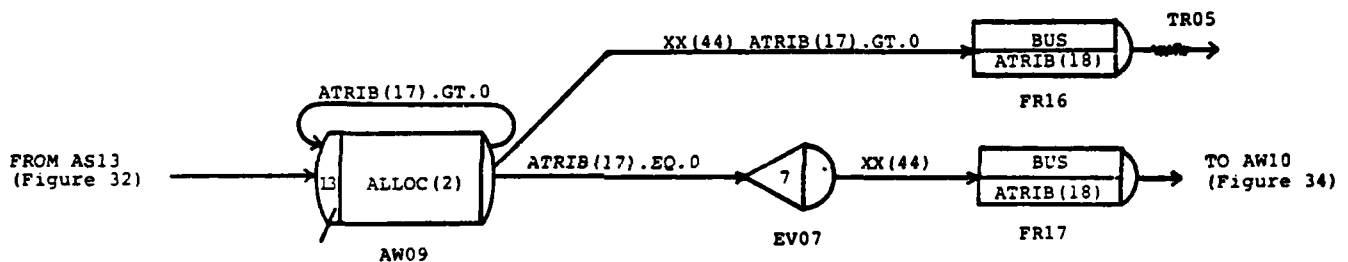


Figure 33: Bus Routing, Passenger Staging to Passenger Terminal

PASSENGER TERMINAL

Node AW10 (Figure 34) allocates space in the passenger terminal (resource PAXTERM). Because the number of spaces needed must be determined, Subroutine ALLOC(5) is used. If sufficient spaces are not available, the FRN will be held in File 14. Since this is considered an essential resource, the FRN will not be allowed to pass until the resource is allocated.

At that time, the FRN proceeds to AW11, where it waits for a passenger agent (resource PAXAGENT) to become available. When one is allocated, the final processing begins. The duration of the processing is determined by USERF(12). Upon completion, the PAXAGENT is freed by node FR18.

From node FR18, a maximum of one entity may be released. This allows the users to effect various policies regarding the mode of transportation to the aircraft. XX(46) is the percentage of aircraft parking spots within walking distance of the terminal. All others require bus transportation. The first branch examined will route the FRN via foot if a random number drawn is less than XX(46). If this branch is not taken, the FRN is sent to node AW12, where it awaits bus transportation.

If the first branch was taken, the FRN will be sent to node AS15, where the time to departure is calculated by USERF(16). After this time has elapsed, the FRN will pass through node EV10, which frees the terminal space it held. The final node encountered is the COLCT node C001, which collects statistics on the difference between the scheduled and actual departure times. A histogram is specified to be prepared in half-hour increments from -1.5 to +3.5 hours (representing 1.5 hours early to 3.5 hours late).

BUS ROUTING, PASSENGER TERMINAL TO AIRCRAFT

If the second branch from node FR18 was taken, the FRN will be sent to node AS16, where its time to departure will be calculated, along with the number of buses needed. It then proceeds to node AW12 (Figure 35), where it enters the familiar bus allocation routine. As the last busload departs, node EV09 causes the terminal space to be freed. After the last bus is freed, the FRN passes through node CO01, where its statistics are collected as above. This concludes the passenger subnetwork.

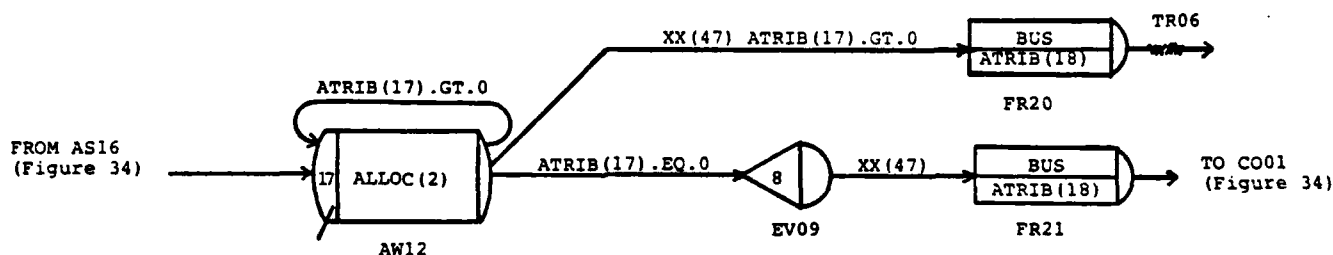


Figure 35: Bus Routing, Passenger Terminal to Aircraft

THE CARGO SUBNETWORK

The initial cargo sorting was explained in the earlier discussion of the cargo/passenger sorting (Figure 21). This sorting routed the cargo according to type, as reflected by Attribute 10. The following discussion will consider each type in turn.

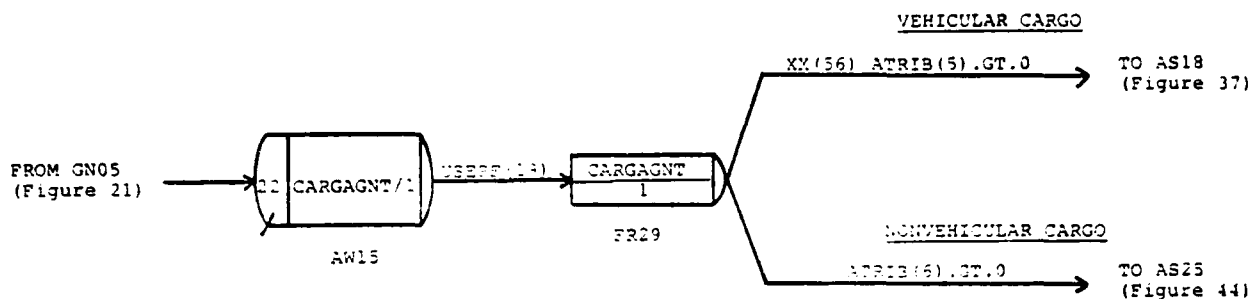


Figure 36: Off-Base URC Reception Point

OFF-BASE URC RECEPTION POINT

Off-base URC first encounters node AW15 (Figure 36), which allocates a cargo agent (resource CARGAGNT) to perform the initial inprocessing. The duration of the inprocessing is calculated by USERF(19), following which the cargo agent is freed. The FRN is then routed to either the vehicle processing branch, the pallet processing branch, or both. If the FRN contains vehicular cargo, the vehicles are sent to node AS18, with a time to arrival of XX(56). If the FRN contains nonvehicular cargo, it is routed to node AS25.

For ease of discussion, the entire vehicle branch will be explained first, followed by the pallet branch.

WASHRACK

The first step in the vehicle processing is the wash-rack. Node AS18 (Figure 37) defines the number of vehicles in this FRN with USERF(18), and places that number into Atrib(17). Atrib(18) is set to zero, and will be used to reflect the number of units of resource allocated. (To

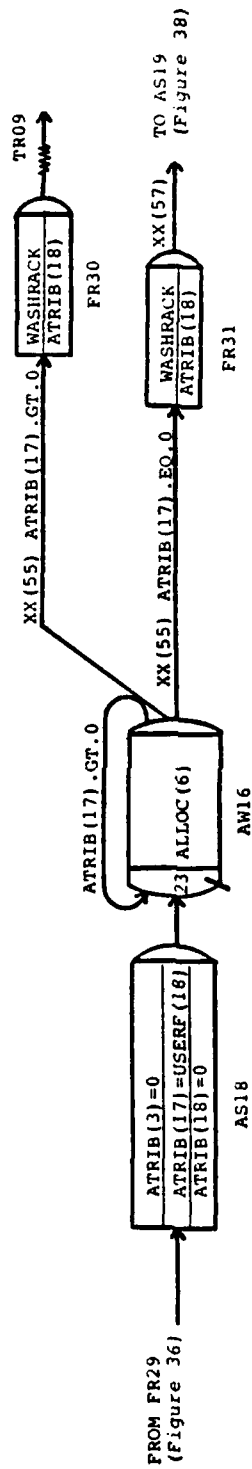


Figure 37: Washrack

the maximum extent possible throughout the cargo subnetwork, Atrib(17) is used to represent the units of resource needed, while Atrib(18) reflects the units currently allocated.) Atrib(3), which will be used later, is set to zero.

Node AW16 allocates the washracks (resource WASHRACK) in a manner analogous to the allocation of buses in the passenger subnetwork. Since there may be more vehicles than washracks (just as there might have been more busloads than buses), Subroutine ALLOC(6) cycles the FRN until Atrib(17) is decremented to zero, at which time the entire FRN is allowed to proceed through to node AS19. The duration of the washrack activity is XX(55), and the transit time to the next area is XX(57).

OTHER PROCESSING (VEHICULAR)

This area, shown in Figure 38, is structurally identical to the washrack. The allocation is handled by Subroutine ALLOC(7). The activity duration is XX(58), and only after all vehicles have been processed is the entire group allowed to proceed. This resource (labelled VEHPROCS), like the WASHRACK, is considered essential, since vehicles will not be loaded until all processing is completed. Therefore, the allocation logic will hold the FRNs in a file if necessary until the needed resource becomes available. Following completion of vehicle processing, the FRN is routed to node AS20.

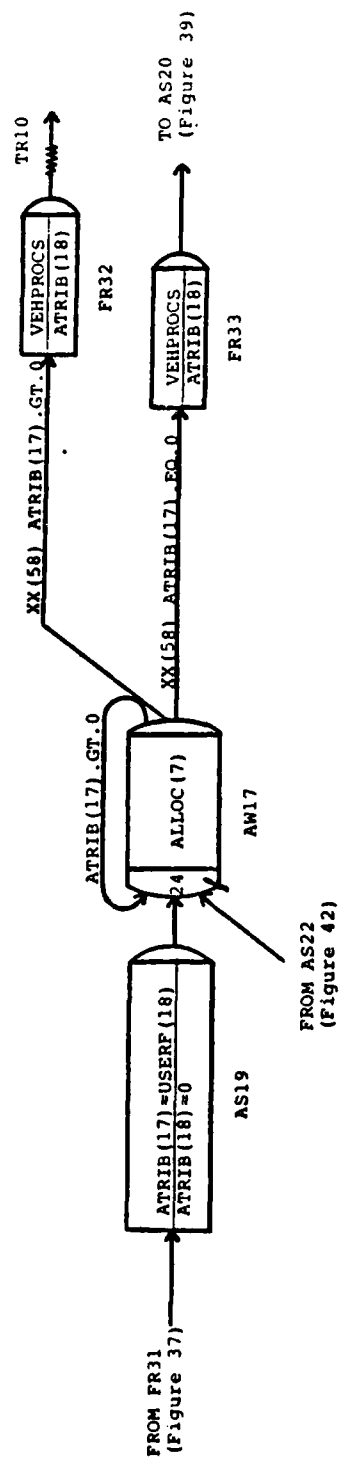


Figure 38: Other Processing (Vehicle)

VEHICLE ROUTING TO JOINT INSPECTION

Node AS20 (Figure 39) defines the time remaining before the scheduled departure with USERF(20), and places this time in Atrib(11). It then recalculates the number of vehicles with USERF(18), placing this value in Atrib(17). Attributes 3 and 4, which will be used later, are set to zero.

The branching taken from AS20 is dependent upon the value in Atrib(11). If this value, the time remaining before departure, is less than XX(64) the FRN is routed directly to node AW19 (the joint inspection) with a time to arrival of XX(59). Otherwise, it is routed to node AW18, which allocates space in a vehicle parking lot (resource VEH PARK) as a short-term holding area. It is assumed that if this resource is exhausted, some other vacant area will be appropriated. Therefore, this resource is considered nonessential, and no FRN will be forced to wait for it in a file. Rather, a message will be printed identifying any shortfall.

Following a period of time defined by USERF(21), the parking is freed by node FR34. The vehicles then move to node AW19, with a time to arrival of XX(66).

JOINT INSPECTION (VEHICLES)

Upon arrival at node AW19 (Figure 40), each FRN carries with it Atrib(17), which is the number of vehicles

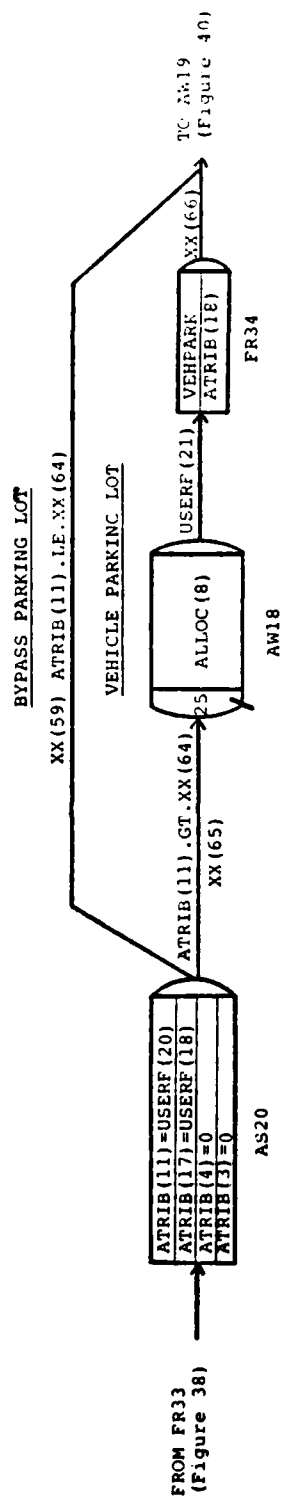


Figure 39: Vehicle Routing to Joint Inspection

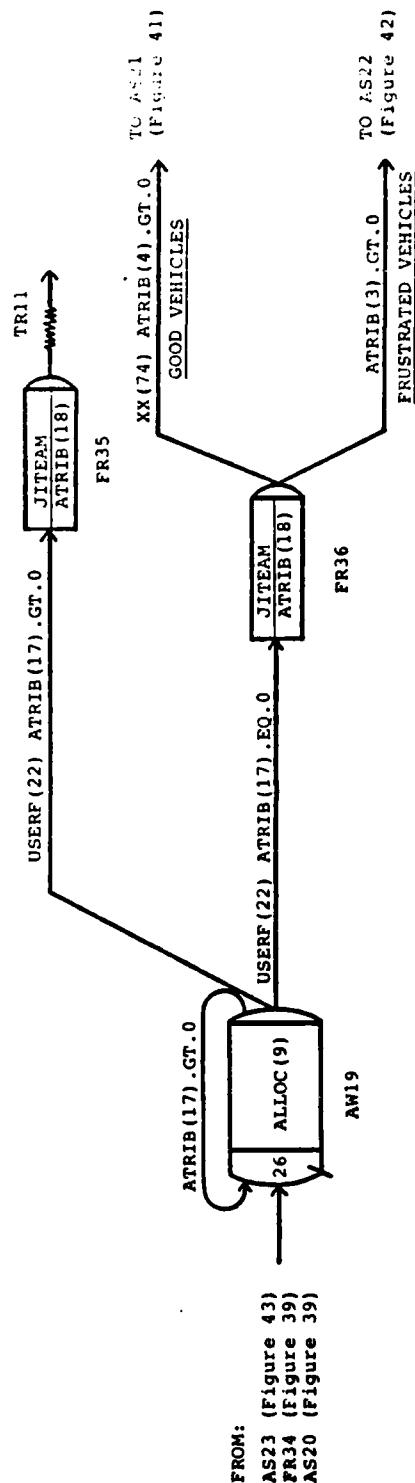


Figure 40: Joint Inspection (Vehicles)

needing inspection. Subroutine ALLOC(9) allocates the resource JITEAM, using logic analogous to that used for bus transportation. The FRN is cycled back to AW19 until Atrib(17) is decremented to zero, indicating that there are no more vehicles to be inspected. In order to model the chance that a vehicle will fail the inspection, the user is allowed to define XX(60) as the percentage of failures. ALLOC(9) will then examine each vehicle inspected in light of this failure rate by drawing a random number. If the number is less than XX(60), the vehicle is considered to have failed, and Atrib(3) (used here to track the number of failures) is incremented by one. Otherwise, the vehicle is considered to have passed, and Atrib(4) (used here to track the number of passes) is incremented by one. The duration of each cycle, reflecting the inspection time, is calculated by USERF(22).

The outcome of this routine is a single FRN, which now may be split according to the number of passed and failed vehicles. By way of illustration, consider a group of five trucks entering AW19. Assume that only four JITEAMS are available. Upon entry, Atrib(17) is five, and Atribs(3) and (4) are both zero. The four JITEAMS would be allocated, and Atrib(17) would be decremented to one. Depending on the value of XX(60) and the draw of the random numbers, Atrib(3) and (4) would be incremented. For this example, assume that there are three passes and one failure.

The FRN would be released, with a copy cycling back to AW19. This FRN carries with it Atrib(17) equal to 1, Atrib(3) equal to 1, and Atrib(4) equal to 3. After the time defined by USERF(22) has passed, node FR35 will free the four JITEAMS. One of them will be allocated to the FRN waiting at AW19. Assume that this one vehicle passes inspection. Its Atrib(4) is incremented to 4. Since Atrib(17) was decremented to zero, the FRN is routed to FR36. When it arrives, the one JITEAM is freed.

At this point, the branching from FR36 will route passed vehicles to the marshalling area (node AS21), and failed vehicles to a frustrated vehicle processing area (node AS22). In the example above, the one FRN would be split and sent both ways, since it has both types of vehicles, four of which passed and one which failed.

MARSHALLING AREA AND URC DEPARTURE

Upon entry into the marshalling area, it is necessary to convert the number of vehicles back into short tons. Therefore, node AS21 (Figure 41) calculates Atrib(17) with USERF(23), which keys on the number of passed vehicles (Atrib(4)) and the average vehicle weight. In a like manner, AS39 will convert the number of pallets arriving from the pallet processing branch into short tons. Both are then routed to AW20, where space in the marshalling area is allocated.

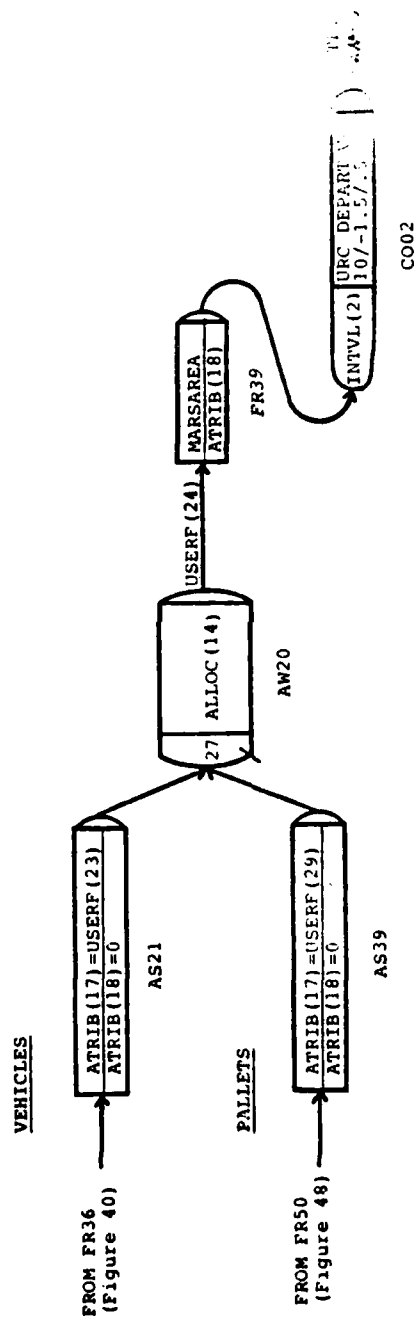


Figure 41: Marshalling Area and URC Departure

Subroutine ALLOC(14) assumes that an overflow of the marshalling area will not prevent timely departures. Therefore, the resource (MARSAREA) is considered nonessential. Should the available capacity be exhausted, a message is printed to that effect, and the FRN is allowed to proceed. After a period of time defined by USERF(24), the MARSAREA in use by this FRN is freed, and the FRN passes through node CO02, which collects statistics on the departure time variance. The FRN is then destroyed.

The model, in doing this, excludes the resources and processes involved in loading the cargo onto the aircraft. These resources and processes are an important part of the overall system, and should be included in future refinement of this model so as to provide a more complete picture of the reception system operation. This effort has been left to future researchers, and the cargo is assumed to 'disappear' at the appropriate time.

FRUSTRATED VEHICLE SORTING

The vehicles which previously had failed the inspection were sent to node AS22 (Figure 42). At this point, Atrib(17) is set equal to Atrib(3), the number that failed. The user is allowed to specify the percentage of failures due to processing problems other than improper washing as XX(62). All others are due to improper washing. The branching from AS22 is identical to that out of the passen-

ger terminal. A random number is drawn. If it is less than XX(62), the FRN is sent back to node AW17 (previously discussed) for reprocessing. Otherwise, the FRN is sent to node AW21, where it awaits reallocation of the WASHRACK resource.

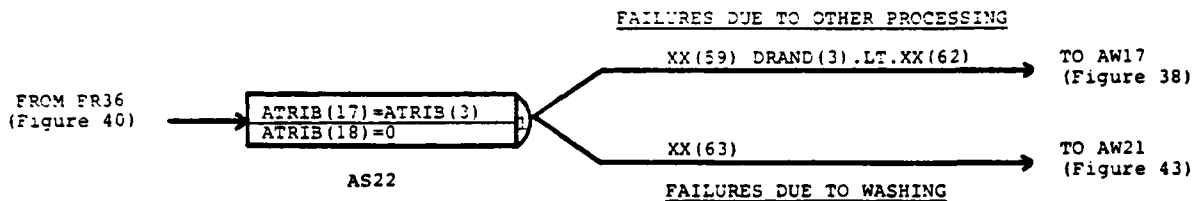


Figure 42: Frustrated Vehicle Sorting

As presently designed, this routine considers that all failed vehicles from a single FRN have failed for the same reason. In other words, a group of ten frustrated vehicles arriving at AS22 will all be sent to one location or the other. They will not be split with some going to be rewashed and the rest to be reprocessed. Future researchers may wish to alter this logic as they make refinements to this model.

WASHRACK (FRUSTRATED VEHICLES)

At node AW21 (Figure 43), vehicles which require re-washing wait for the WASHRACK resource to become available. This is the same resource that was used in AW16, and the same ALLOC routine. Since these vehicles would have higher priority, though, available WASHRACK resources are given

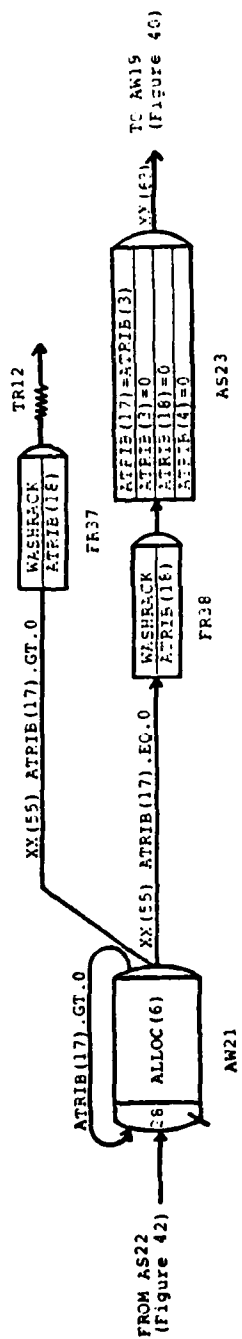


Figure 43: Washrack (Frustrated Vehicles)

first to vehicles at AW21. Following rewashing, the resource is freed, and the FRN proceeds to AS23. Its attributes are redefined so as to prepare it for reinspection. It is then returned to AW19, where it awaits reinspection.

PALLET PROCESSING BRANCH

ALLOCATION OF AND ROUTING TO UNIT ASSEMBLY AREAS

Nonvehicular cargo was routed from the cargo reception point to node AS25 (Figure 44). At this point, Atrib(17) is defined as the number of pallets in this FRN by USERF(25). Attributes 3, 4, and 18 are set to zero for future use. The FRN is then sent to AW22, where it is allocated space in the unit assembly areas.

Managers have the option of establishing up to five unit assembly areas, each of which must be defined in terms of the number of pallets it can accommodate. They are labelled UASAREA1 through UASAREA5, in decreasing order of preference. Subroutine ALLOC(10) closely parallels the billeting area allocation, with the exception that there need not be room for the entire FRN at once. Should only part of the needed space be available, it is allocated and the remainder of the pallets are routed through AS40 back to AW22, where they await more resource. Nodes AS26 through AS30 zero out the attributes reflecting some part of this FRN sent to another area, therefore establishing both the number of pallets in this group and precisely which area it

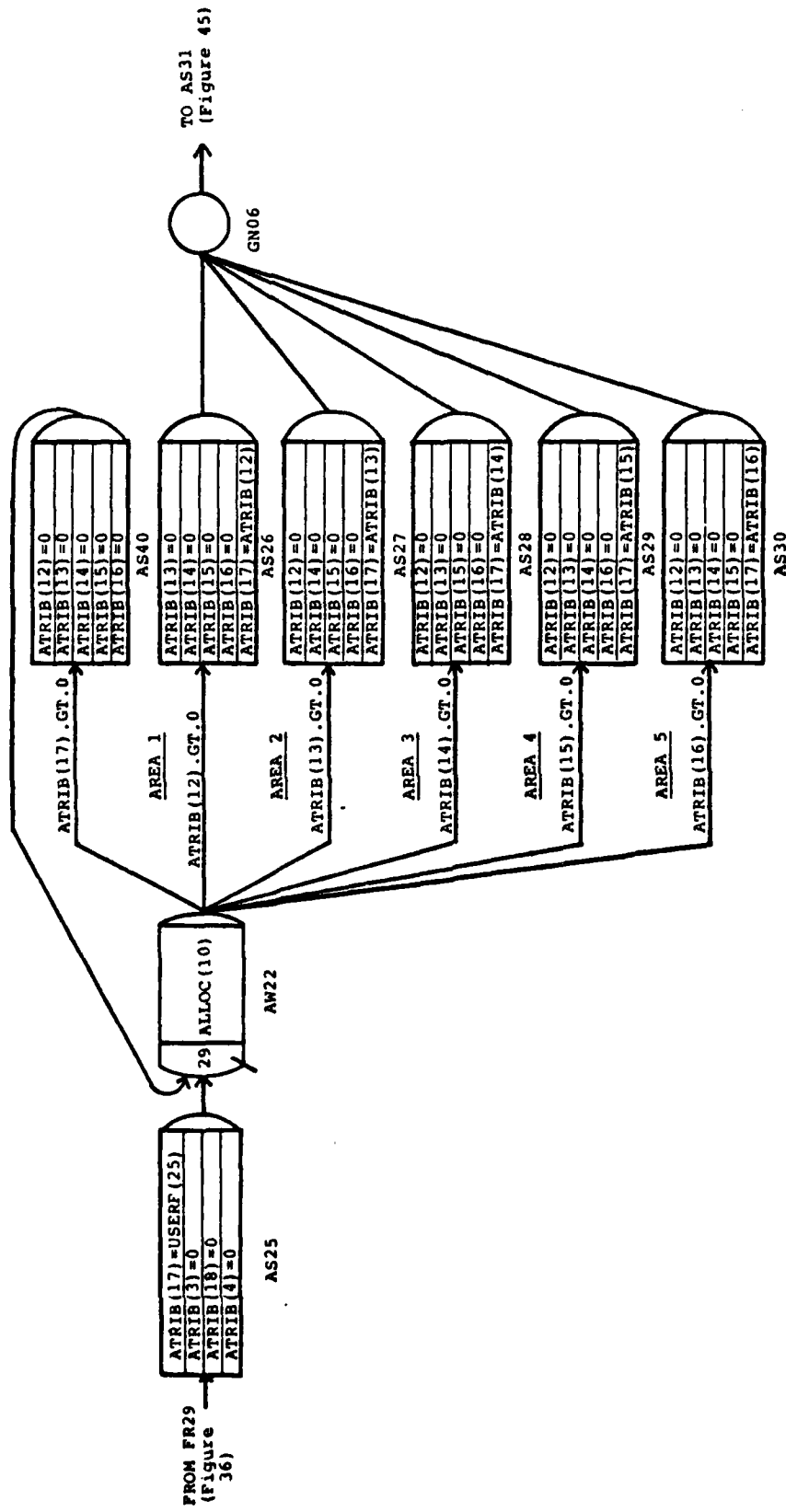


Figure 44: Allocation of and Routing to Unit Assembly Area

is in. Therefore, a single FRN arriving to AW22 may produce any number of separate FRNs, depending on the availability of UASAREAs. From AS26 through AS30, the FRNs are sent to GN06, and then on to AS31 (representing entry into the appropriate unit assembly area).

UNIT ASSEMBLY AREAS

The model assumes that the cargo arrives on trucks, and therefore needs no transportation to the unit assembly areas. It further assumes that most of the cargo will not arrive on pallets, and therefore will be unloaded by hand, rather than forklift. The branch to AS31 (Figure 45) has a duration of USERF(26), representing the processing time needed in the unit assembly areas. After that time has elapsed, AS31 calculates Atrib(11) with USERF(21), which checks to see how much time is remaining before the cargo should be moved to joint inspection. After that time has elapsed, the cargo enters node AW23, where it awaits the resources FLATBED and UASFORK.

These resources are used to move the pallets to the inspection station. The FLATBED is capable of carrying four pallets at a time, and the UASFORK is a standard forklift used to load the FLATBED. The model assumes that no other means of transportation are available. (Such elaboration is left to future researchers.) It further assumes that the UASFORK can move freely from one assembly area to another, and that there is no transit delay for such moves.

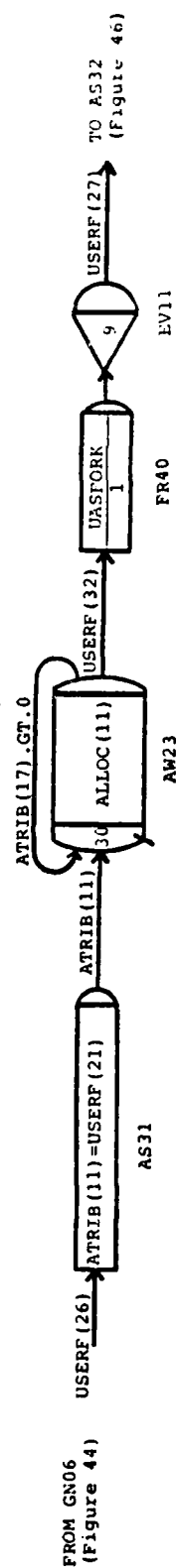


Figure 45: Processing in and Pallet Loading at Unit Assembly Areas

Subroutine ALLOC(11) allocates the FLATBED and UASFORK when one of each is available. It checks Atrib(17) to see how many pallets there are. If there are less than four, Atrib(18) is set to this number and Atrib(17) is decremented to zero. Otherwise, Atrib(17) is decremented by four and Atrib(18) is set to four, showing that there are four pallets on this load. The cargo is then allowed to proceed. If Atrib(17) now shows that more pallets need transportation, a copy of the FRN is routed back to AW23, where it repeats the allocation process.

Unlike previous routines, this routine allows the partial FRN to continue into the next part of the network. After a delay calculated by USERF(32), representing the time to load the FLATBED, it encounters FR40, where the UASFORK it was using is freed. It next passes through EV11, which frees the unit assembly area from which the pallets came. It is then sent to AS32 (the inspection area), with a time to arrival determined by USERF(27).

From this point on the pallets will be in groups of no more than four. This strategy was chosen as being the more realistic of the alternatives, since the inspectors would not wait for the entire FRN to arrive before beginning their inspection.

PALLET UNLOADING AT JOINT INSPECTION

Node AS32 (Figure 46) defines Atrib(17) as the number of pallets needing unloading by setting it equal

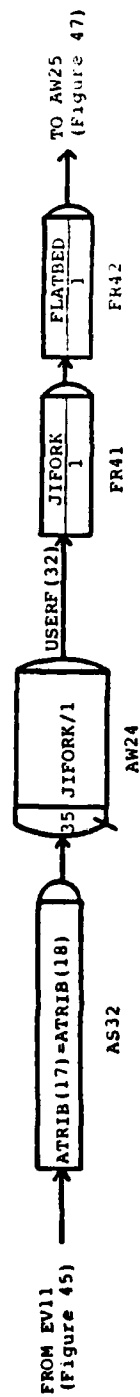


Figure 46: Pallet Unloading at Joint Inspection

to Atrib(18), the number of pallets on this load. The cargo then proceeds to AW24, where the joint inspection area fork-lift (resource JIFORK) is allocated. The unloading time is defined by USERF(32), and depends on how many pallets there are. Following this time, the JIFORK and FLATBED are freed, and the cargo moves to AW25, where it awaits an inspector.

JOINT INSPECTION (PALLETs)

The inspection routine for pallets is identical to that described previously for vehicles. Upon arrival to AW25 (Figure 47), Atrib(17) is the number of pallets needing inspection. The same allocation routine (ALLOC(9)) is used, which means that although this is a separate part of the network it is using the same resource, and is dealing with the same area as was discussed earlier. The duration of the inspection is determined by USERF(28). The percentage of failures defined by the user is used to determine how many pallets require further processing. (Note that the vehicles and pallets will have the same failure rates. The modifications necessary to effect different rates would involve a separate allocation routine with different failure rates, which could be developed by future users of the model.) The routing out of the inspection station is parallel to that used for vehicles, with passed pallets sent to AS38 and frustrated (failed) pallets sent to AS35.

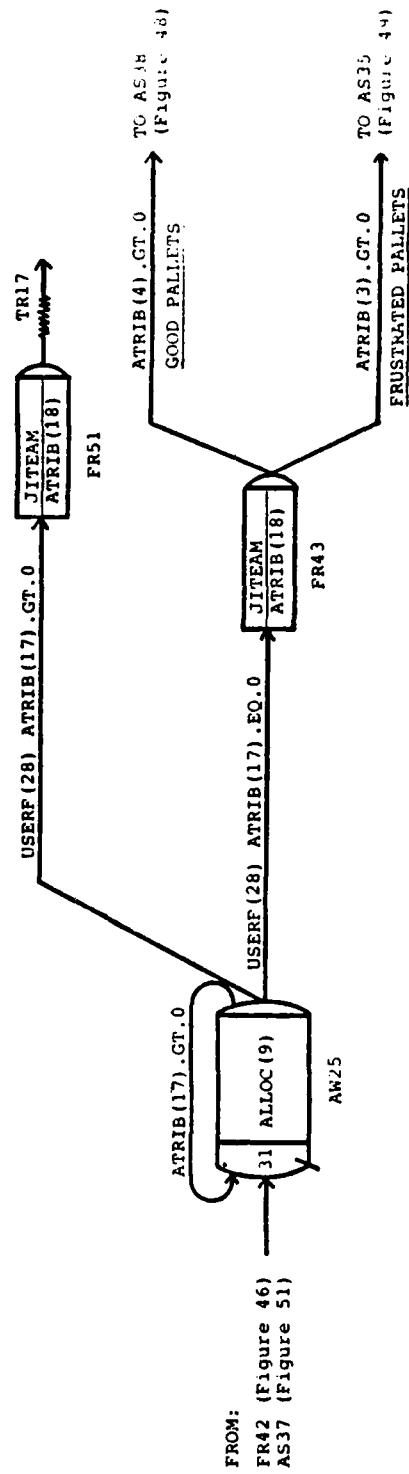


Figure 47: Joint Inspection (Pallets)

PALLET TRANSPORTATION TO MARSHALLING AREA

The routine used to move the pallets into the marshalling area (Figure 48) is similar to that used in other areas. AS38 defines Atrib(17) as the number of pallets to be moved, and sets Atribs(18) and (3) to zero. It then checks the time remaining to departure (Atrib(11)). If the cargo is late, a message is printed to that effect. The cargo then moves to AW29, where the same logic used previously for buses is employed to allocate JIFORKs. The movement time is XX(73). After the last pallet is moved, the FRN is routed to AS39, where it merges with the vehicle branch (Figure 41).

PALLET TRANSPORTATION TO THE FRUSTRATED PALLET AREA

The routine used to move the pallets to the frustrated pallet processing area (Figure 49) is identical to that used above. The transit time is XX(72), and when the last pallet has been moved the FRN is sent to AS36, where it enters the frustrated pallet area.

FRUSTRATED PALLET AREA

Node AS36 (Figure 50) prepares the FRN for allocation of space in the frustrated pallet area (resource FRUSTCAR) by setting Atrib(17) equal to Atrib(3), the number of failed pallets in this group. It then sets Atrib(18) to zero, and the FRN is allowed to proceed to AW27, which allocates the resource. On the assumption that an overflow

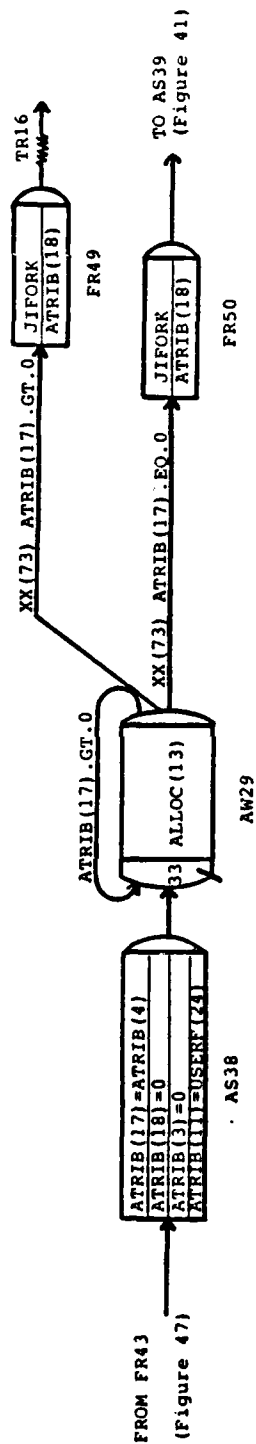


Figure 48: Pallet Transportation to Marshalling Area

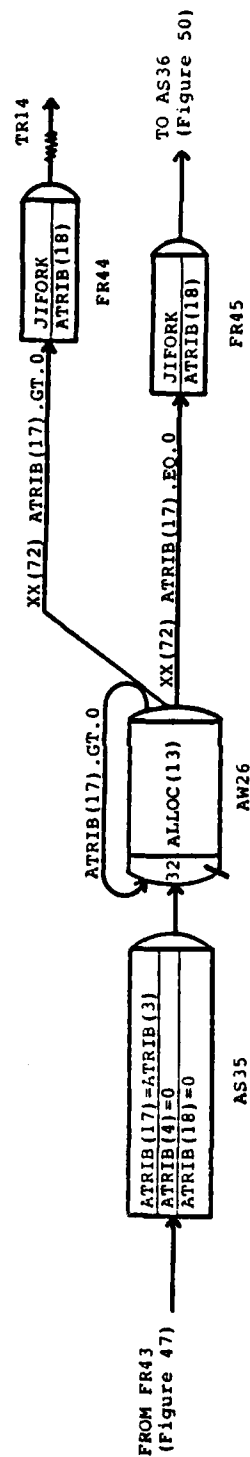


Figure 49: Pallet Transportation to Frustrated Cargo Area

of this area would not prevent the corrective actions from proceeding, the FRUSTCAR resource is considered nonessential. When the available space is exhausted, a message is printed identifying the shortfall, and the cargo is allowed to proceed. The time required for corrective processing is determined by USERF(30). Once this time has elapsed, the FRUSTCAR held by the FRN is freed, and the FRN is sent to AW28, where it awaits transportation back to the inspection area.

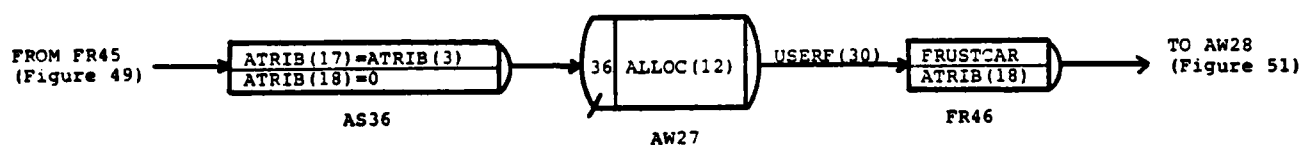


Figure 50: Frustrated Cargo Area

PALLET TRANSPORTATION, FRUSTRATED PALLET AREA TO JOINT INSPECTION

This routine (Figure 51) is simply a reapplication of the pallet transportation logic used in several previous areas. The duration for this return trip is XX(72). After the last pallet is moved, AS37 prepares the FRN for entry to the JITEAM allocation routine by making appropriate changes to the attribute values. Atrib(17) becomes the number needing inspection (formerly the number which failed). Atrib(3), which will be the number which fails this time, is set to zero, as is Atrib(18), the number of JITEAMS

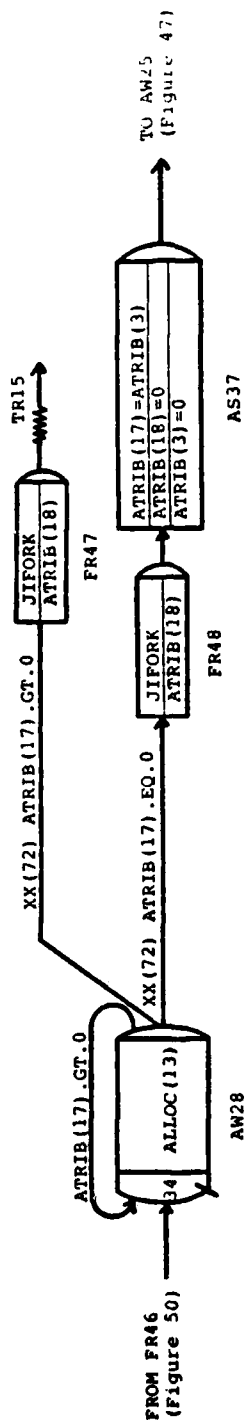


Figure 51: Pallet Transportation out of Frustrated Cargo Area

currently allocated. The FRN is then sent into AW25, and repeats the cycle previously discussed. This concludes the discussion of the off-base unit-related cargo branch.

ON-BASE UNIT-RELATED CARGO

As was shown in Figure 21, on-base URC is sent to node GN07 (Figure 52). From there, it is sorted with the vehicles being sent to AS18 (the washrack discussed above) and the pallets being sent to AS41. At AS41, the pallets are prepared for the JITEAM allocation routine by having the necessary changes made to the attribute values. They are then routed to AS31, where they await loading and transportation to the inspection area and merge into the off-base URC branch as described earlier.

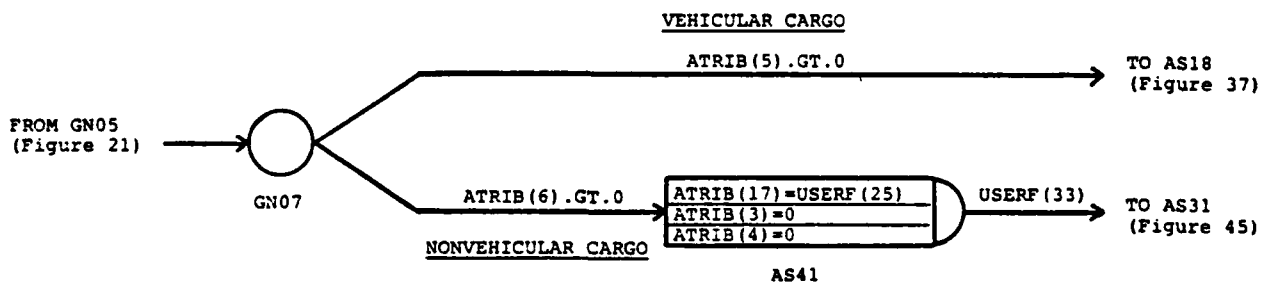


Figure 52: On-Base URC Routing

This assumes that the UASFORK resource will be sent to the on-base unit's area to load the pallets, and that there is no transit delay involved. It further assumes that on-base vehicles will be processed side by side with the off-

base vehicles. If these assumptions are not valid for a particular base, the network must be modified.

OFF-BASE NONUNIT-RELATED CARGO

From node GN05 (Figure 21), the off-base NRC is sent to AS42 (Figure 53) which represents its entry into the NRC reception point. At AS42, the total short tonnage of the cargo is converted to the nearest integer by USERF(37). This is necessary because the subsequent allocation of space in the NRC reception point (resource NRCRECPT) uses Atrib(17) as the units needed, and this must be an integer value. The allocation of NRCRECPT is handled by AW30. Following this, the cargo waits for an agent (resource NRCAGENT) to become available at node AW31. Both of these resources are considered essential; the cargo will wait in the files until the resources become available and are allocated.

Once an agent is allocated, the cargo is manifested and other paperwork is processed. The duration of this activity is determined by USERF(34). At the end of this time, the NRCAGENT is freed, and the cargo moves through node AS43.

NRC TRANSFER TO THE CARGO TERMINAL

At node AS43 (Figure 54), the time remaining until departure is calculated and placed into Atrib(11). If the cargo has already missed its scheduled departure, a message

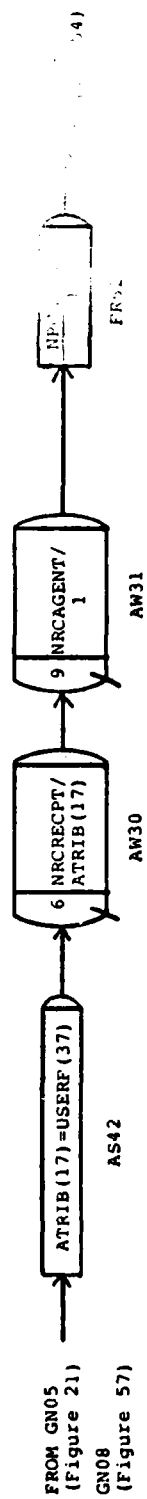


Figure 53: NRC Reception Point

is printed to that effect. The cargo next passes through node FR53, which frees the NRCRECPT which it was given. It is then routed to node AW32, representing its transfer to the air cargo terminal. The duration of XX(75) is the time needed for the move. The model assumes that the cargo was not unloaded at the reception point, and therefore requires no forklifts or flatbeds for this move.

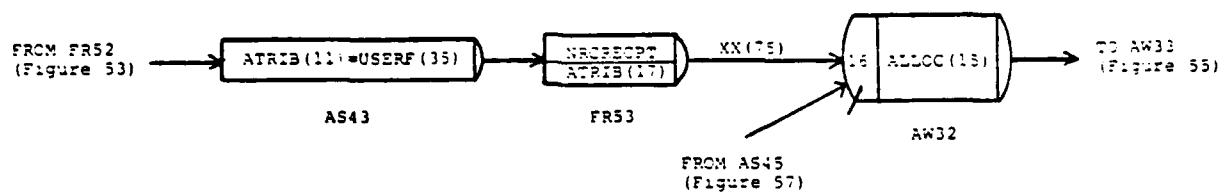


Figure 54: Routing to NRC Terminal

At node AW32, the space in the cargo terminal (resource NRCTERM) is allocated. This space, like the marshalling area, is measured in tonnage capacity. Also like the marshalling area, it is considered nonessential. Therefore, if the available space is exhausted, a message is printed identifying the shortfall and the cargo is allowed to proceed to node AW33, where it waits for a forklift to unload it.

NRC UNLOADING AT THE NRC TERMINAL

The structure of the routine shown in Figure 55 is identical to that used elsewhere for pallet movement. The sole difference here is that the cargo to be unloaded is not

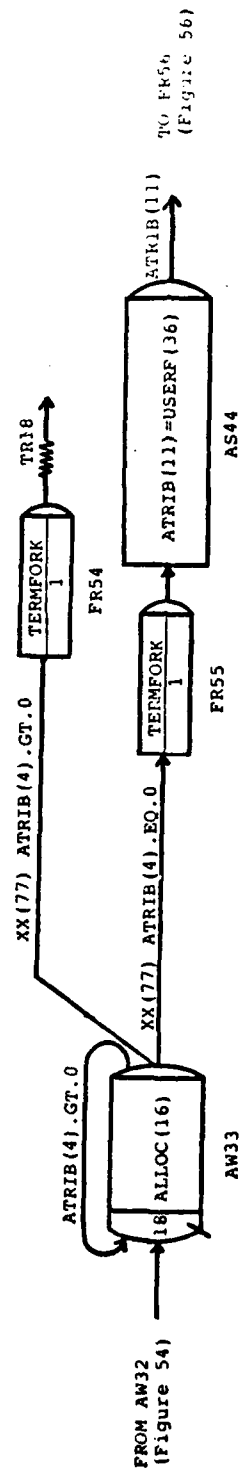


Figure 55: Pallet Unloading at NRC Terminal

identified as a certain number of pallets. Therefore, the routine assumes that each load on the forklift (resource TERMFORK) weighs 1.5 tons. Atrib(4), the total tonnage to be unloaded, is decremented by 1.5 every time a TERMFORK is allocated. When Atrib(4) has been decremented to zero, the entire load has been unloaded. In the routine, it is possible to have all available TERMFORKs working on the same load. However, they are still allocated and freed one at a time.

After the cargo unloading is complete, AS44 calculates the time to departure and places it in Atrib(11). Once more, if the cargo has missed its departure a message is printed to that effect. It is then routed to FR56, with a time to arrival equal to the time remaining before departure (Atrib(11)).

NRC DEPARTURE

Upon arrival at FR56 (Figure 56), the NRCTERM held by the cargo is freed. The cargo then passes through node C003, which collects statistics on the difference between the scheduled and actual departure times (as did C001 and C002 for the passengers and URC, respectively). The cargo then is eliminated from the system by node TR19 as it departs.

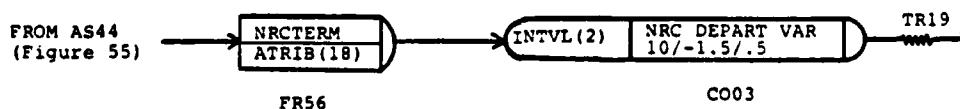


Figure 56: NRC Departures

As was discussed for the URC, the model does not account for the processes or resources used to load the cargo onto the aircraft, due to the inability to aggregate it into full loads. Instead, when the cargo reaches the end of the branch it is on, it simply disappears. As mentioned earlier, this is a prime area for future modelling efforts.

ON-BASE NONUNIT-RELATED CARGO

The routing of on-base NRC, shown in Figure 57, simply feeds directly into the off-base NRC branch discussed above. Because the procedures for processing the paperwork may vary from one base to another, the users may specify in XX(76) whether or not the paperwork for on-base NRC will be processed by the NRCAGENTS as discussed above. If it is, the cargo is routed to AS42; if not, it is assumed that the paperwork will be processed elsewhere and the cargo is sent to AS45. At that point, the tonnage is rounded to the nearest integer, and the cargo merges into the off-base NRC branch at AW32.

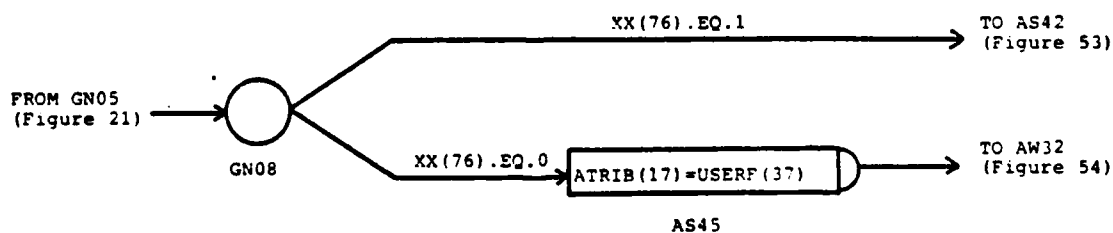


Figure 57: On-Base NRC Routing

This concludes the discussion of the Phase II network. The model attempts to capture all major activities which take place in the reception system for which reasonably reliable projections are available in the JDS data base. As was mentioned in previous chapters, the information for movement of NEOs, wounded personnel, and retrograde cargo is incomplete at this time. Therefore, the parts of the system which would deal with those areas are left for future researchers to develop. The following sections will outline the Phase II output products.

THE PHASE II OUTPUT PRODUCTS

The Phase II model uses the standard SLAM output reports. These provide a great deal of information, but require careful analysis to insure proper interpretation. The following discussion will consider each section of the output in turn.

The first section lists the network input statements. The statements of most interest to the user are the RESOURCE statements, which define the resource labels, the quantity available, the associated files, and the resource number (included as a comment). The associated files are the files at which FRNs will wait for the resource to be allocated, and will be discussed later. As was mentioned early in this chapter, the order of these resource statements determines the resource number assigned internally. The comment after

each line is intended to allow the user to verify that the proper sequence has been maintained, and to allow easier interpretation of the user-written subroutines which use the numbers instead of labels.

The Echo Report, which repeats the initialization parameters, is printed next. After the Echo Report, the Intermediate Results section is printed. It is here that any of the user-coded warning messages will be printed, as well as the trace statements if that option was selected.

The next section is the SLAM Summary Report. The first information given is the stopping time of the simulation. This may be earlier than the user specified, since the run will terminate when there are no more events to process. Next, the statistics collected at the three COLCT nodes are presented.

Following that, file statistics are presented. These include the average length, maximum length, current length, and the average waiting time. Recalling that File 1 is not associated with a resource, the user can scan the maximum length and waiting time columns for the other files to determine if any backlogs occurred. By referencing the resource statements in the network input, the user can determine the resource causing the delay. Note that this only applies to those resources considered essential, as there is never going to be a wait for the nonessential resources. Also, note that the last file in the list is the

'future events file' used internally by SLAM.

After the file statistics are the resource statistics. These show the capacity; average, maximum, and current utilization; and current, average, minimum, and maximum availability. This table, in conjunction with the file statistics, is of primary importance to the managers. These two tables will show both the resources which are critically short and those which are underutilized. Taking this information together with the warning messages for the nonessential resources will give the user a very complete picture of how efficient the system is.

The final section of the Summary Report is a pictorial presentation of the statistics collected on the departure variances for passengers, URC, and NRC. This is, in effect, the 'report card' for the reception system, as it shows the percentage of departures which were late. The data for each group are presented in a histogram, which is set up in half-hour increments from 1.5 hours early to 3.5 hours late. Tabular statistics are also repeated here.

This completes the discussion of the Phase II output products. In the next chapter, an example run will be discussed in detail in order to fully demonstrate the use of these products.

VALIDATION AND VERIFICATION OF THE PHASE II MODEL

The validation and verification of the Phase II model involved the same procedures used for the Phase I model (discussed in Chapter 3). Imbedded trace statements and the SLAM TRACE option were used to insure that the model functioned properly. Here again, the model was validated through discussions with AFLC planners, since it does not model a particular reception system.

CHAPTER SUMMARY

This chapter has discussed the Phase II model. The structure of the network and the different types of resource allocation logic were explained. The comments embedded in the Phase II code (Appendix D) were relied on to provide additional detail not provided in this chapter. The flexibility that these user-written subroutines provide was emphasized.

The next chapter will present an application of the two phases of the model using a hypothetical data base. The output from each of the models will be analyzed, pointing out the conclusions the users should draw from such runs. In the Phase II demonstration, a hypothetical reception plan will be used to establish the initialization parameters for the resource levels and subroutines.

CHAPTER 5

DEMONSTRATION OF THE MODELS

INTRODUCTION

The preceding chapters have discussed in detail the structure and function of both the Phase I and Phase II models. They have outlined the input data preparation and other actions necessary to operate the models and have explained the different output products.

This chapter will demonstrate the operation of both models. A randomly generated data base was used as the source for incoming FRNs, and a fictitious reception plan was used as the basis for the Phase II user-written sub-routines. This discussion follows the flow of actions which would occur if this were an actual application of the methodology. However, since a randomly generated data file was used, the TPFDD data preparation will not be discussed. Comments on that subject appear in Chapters 3 and 4, and in Appendix F. Furthermore, since the demonstration runs used here are unclassified, the procedures used for classified operation of the models will not be included in this chapter. These procedures, which are specific to the computer resources at Wright-Patterson AFB, are discussed in Appendix F.

PHASE I OPERATION

The Phase I model was operated using the same sub-routines which generate the hypothetical workload discussed with EVENT(10) in Appendix D. In this manner, the same workload was presented to both models in this demonstration.

PHASE I OUTPUT

The Phase I output products consist primarily of plots. These plots show the population of people or tonnage of cargo in different areas over the duration of the run, whether it be for one day or 90 days of simulated time. This demonstration run covered the full 90 days of activity which is included in the standard TPFDD data.

The first section of each plot (Figure 58) lists the variables which appear on that plot, and shows the minimum and maximum values of each. This is valuable as a means to quickly check for peak workloads. The next section presents the variables, the symbols associated with each variable on the plot, and the scales associated with each. Note that the user specifies the scales in the VAR input statements, and that each variable could have a different scale (although this could make it difficult to compare the variables). Immediately under this is a percentage scale (0-100) which will be discussed later.

The body of the plot (Figure 59) has the current

TABLE NUMBER 188
RUN NUMBER 1

CURRENT TIME	NONDEPRS	PAI STAGN	TERMINAL	TRANSBIL	UNITCKIN	MUNTCKIN	DEPTODAY
MINIMUM	0.	0.	0.	0.	0.	0.	0.
MAXIMUM	.1221E+05	.1390E+04	.6610E+03	.1304E+04	.7810E+03	0.	.3546E+04

TABLE NUMBER 188
RUN NUMBER 1

	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
N=NONDEPRS	0.						.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03
S=PAI STAGN	0.						.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03
T=TERMINAL	0.						.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03
B=TRANSBIL	0.						.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03
U=UNITCKIN	0.						.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03
M=MUNTCKIN	0.						.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03
D=DEPTODAY	0.						.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03	.3125E+03

Figure 58: Plot Output Header



Figure 59: Plot Output Body

time listed down the left side. The plot is divided by hash marks at the 25, 50, 75, and 100 percent points. On the right side of the plot, a "duplicates" column lists all pairs of variables which overlap at that time. In such cases, only one will be printed, and the duplication is noted in this column.

To read the plot, the user must note the position of the variable of interest in relation to the percentage hash marks. This percentage is then multiplied by the value appearing at the high end of the scale for that variable. For instance, if a point is at the 40% mark and the scale for that variable is 0 to 1000, the point represents a value of 400. Note that if the scales do not begin at zero, more elaborate interpolation methods must be used. For this reason, it is suggested that zero be used as the starting point for all scales.

Users need not spend vast amounts of time interpreting the plots. The Phase I model was and is conceived as only an approximation of the workload to be encountered. Its primary purpose is to give the users their first look at an unknown workload. Therefore, detailed analysis of the output would not be worthwhile. Rather, the users should focus on the general trends which are indicated by the rise and fall of the plotted lines. As mentioned above, the minimum and maximum values of each variable appear at

the top of each plot. After taking each maximum value into account, the user should then examine the plot to determine the overall level of the workload. This examination should include both the location of the peaks and their frequency, and whether the peaks are isolated or frequent occurrences. The user should also check the workload between peaks.

In this demonstration, Plot 1 (Figure 58) shows that the peak workloads were 12,210 persons in the nondeploying billeting, 1390 in passenger staging, 661 in the terminal, 1306 in transient billeting, 781 in the unit reception point, and none in the nonunit reception point. The maximum daily departure rate was 3546 persons.

As shown in the section of plot in Figure 59, there is a constant fluctuation in the various areas. The users must examine the complete plots, connecting the points in order to gain the insight needed. As was mentioned in Chapter 3, the users have a wide range of options in requesting output from the Phase I model.

PHASE II OPERATION

Using the Phase I workload projections, the managers of the various functional areas in the reception system would then allocate their resources. If the resources currently on hand are not sufficient, they should plan to obtain them through methods such as increased equipment authorizations or contingency lease/rental arrangements with

local vendors. Managers should also establish the physical arrangement of the reception facilities, designating the location of the reception points, marshalling and unit assembly areas, transient billeting areas, and so forth; and plan for relocating any routine functions which will be disrupted by the planned arrangement.

Once the plan is established, the users should then revise the Phase II subroutines which appear in Appendix D so that the transit times, processing times, and other factors reflect the conditions at their base. They would also enter the units of each resource available in the RESOURCE input statements in the network input. At that point, the Phase II model is a model of their particular reception plan. For this demonstration, the model which appears in Appendix D is used, though it does not represent a "good" plan for dealing with the workload projected in the Phase I demonstration. This is done so that examples of both overallocation and underallocation may be found.

PHASE II OUTPUT

The following discussion references several sections of the output report. It follows the flow that the user would follow in an analysis of the output, and therefore will entail a considerable amount of cross-referencing from one section to another.

The user should first note the "Current Time" block

(Figure 60). Phase II simulated a 90-day (2160 hour) reception activity. The current time is shown as 2117, indicating that all activities were completed at that time. The "File Statistics" section (Figure 61), confirms this in the "current length" of File 37 (the future events file), which is used internally to hold all scheduled future events. The user should then scan both the "maximum length" and "current length" figures for all files. With the exception of File 1 (the arriving FRN file), File 37 (the future events file), and Files 12 and 21 (which are not used), all files are associated with an AWAIT node, where resources are allocated. The "maximum length" figures show the maximum number of FRNs that ever waited at any one time for a resource in that file. The "current length" shows the number waiting at the "current time." The "average waiting time" shows the average for all FRNs, including those that did not have to wait. This is expressed in hours.

Scanning the table in Figure 61, the user should notice that 95 FRNs are still in File 2. The RESOURCE input statements (Figure 62) show that File 2 is associated with the resource NODEPBIL, or nondeploying billeting. Recalling that the allocation logic for this resource holds FRNs in File 2 until the resource becomes available, the user has a first indication that this resource is insufficient to meet the requirements.

The output also shows that File 11 had an average

SLAN SUMMARY REPORT

SIMULATION PROJECT PHASE II MODEL BY LARRY E. FORTNER

DATE 8/ 7/1982 RUN NUMBER 1 OF 1

CURRENT TIME .2117E+04
STATISTICAL ARRAYS CLEARED AT TIME 0.

***STATISTICS FOR VARIABLES BASED ON OBSERVATION**

	MEAN VALUE	STANDARD DEVIATION	COEFF. OF VARIATION	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF OBSERVATIONS
PAX DEPART VAR	.7076E+00	.1907E+01	.2695E+01	-.3638E-11	.1372E+02	663
URC DEPART VAR	.4928E+00	.1587E+01	.3220E+01	-.7276E-11	.1157E+02	2517
NRC DEPART VAR	.1357E-01	.1294E+00	.9533E+01	-.7276E-11	.1593E+01	240

Figure 60: Summary Report Header

FILE STATISTICS

FILE NUMBER	ASSOCIATED NODE TYPE	AVERAGE LENGTH	STANDARD DEVIATION	MAX LENGTH	MIN LENGTH	AVERAGE WAITING TIME
1		28.2076	15.8294	1000	0	29.8621
2	AWAIT	49.2355	33.5638	98	0	1074.7693
3	AWAIT	0.0000	0.0000	1	0	0.0000
4	AWAIT	0.0000	0.0000	1	0	0.0000
5	AWAIT	0.0000	0.0000	1	0	0.0000
6	AWAIT	0.0000	0.0000	1	0	0.0000
7	AWAIT	0.0000	0.0000	0	0	0.0000
8	AWAIT	0.0000	0.0000	1	0	0.0000
9	AWAIT	0.0000	0.0000	1	0	0.0000
10	AWAIT	0.0000	0.0000	0	0	0.0000
11	AWAIT	.2697	.8797	9	0	.8612
12		0.0000	0.0000	0	0	0.0000
13	AWAIT	0.0000	0.0000	0	0	0.0000
14	AWAIT	.0034	.0785	3	0	.0108
15	AWAIT	0.0000	0.0000	1	0	0.0000
16	AWAIT	0.0000	0.0000	1	0	0.0000
17	AWAIT	0.0000	0.0000	1	0	0.0000
18	AWAIT	.0380	.2059	3	0	.0128
19	AWAIT	0.0000	0.0000	1	0	0.0000
20	AWAIT	0.0000	0.0000	0	0	0.0000
21		0.0000	0.0000	0	0	0.0000
22	AWAIT	0.0000	0.0000	1	0	0.0000
23	AWAIT	.0312	.1905	3	0	.0731
24	AWAIT	.0006	.0273	2	0	.0011
25	AWAIT	0.0000	0.0000	1	0	0.0000
26	AWAIT	.0706	.3334	6	0	.0822
27	AWAIT	0.0000	0.0000	1	0	0.0000
28	AWAIT	.0004	.0189	1	0	.0071
29	AWAIT	0.0000	0.0000	1	0	0.0000
30	AWAIT	0.0000	0.0000	1	0	0.0000
31	AWAIT	.0893	.7151	13	0	.1278
32	AWAIT	.0001	.0121	2	0	.0009
33	AWAIT	.0005	.0222	2	0	.0008
34	AWAIT	0.0000	0.0000	1	0	0.0000
35	AWAIT	0.0000	0.0000	1	0	0.0000
36	AWAIT	0.0000	0.0000	1	0	0.0000
37		19.6854	13.0079	76	0	.3784

Figure 61: File Statistics

RESOURCE/WIDEPBIL (350), 2;	RESOURCE #1 ESSENTIAL	RESOURCE/WASHRACK (20), 28, 23;	RESOURCE #20 ESSENTIAL
RESOURCE/RECPOINT (800), 3;	RESOURCE #2 ESSENTIAL	RESOURCE/VEHPROCS (50), 24;	RESOURCE #21 ESSENTIAL
RESOURCE/INCHECKR (5), 4;	RESOURCE #3 ESSENTIAL	RESOURCE/VEHPARK (100), 25;	RESOURCE #22 NONESSENTIAL
RESOURCE/BUS (20), 17, 13, 10, 19, 20, 7;	RESOURCE #4 ESSENTIAL	RESOURCE/JITTEAM (20), 26, 31;	RESOURCE #23 ESSENTIAL
RESOURCE/PAXSTG (800), 11;	RESOURCE #5 ESSENTIAL	RESOURCE/NARSAREA (1000), 27;	RESOURCE #24 NONESSENTIAL
RESOURCE/PAXSTGFD (800), 11;	RESOURCE #6 NONESSENTIAL	RESOURCE/UASAREA1 (100), 29;	RESOURCE #25 ESSENTIAL
RESOURCE/BIL1FEED (750), 8;	RESOURCE #7 NONESSENTIAL	RESOURCE/UASAREA2 (100), 29;	RESOURCE #26 ESSENTIAL
RESOURCE/BIL2FEED (500), 8;	RESOURCE #8 NONESSENTIAL	RESOURCE/UASAREA3 (100), 29;	RESOURCE #27 ESSENTIAL
RESOURCE/BIL3FEED (500), 8;	RESOURCE #9 NONESSENTIAL	RESOURCE/UASAREA4 (100), 29;	RESOURCE #28 ESSENTIAL
RESOURCE/BIL4FEED (500), 8;	RESOURCE #10 NONESSENTIAL	RESOURCE/UASAREA5 (100), 29;	RESOURCE #29 ESSENTIAL
RESOURCE/BILSPEED (500), 8;	RESOURCE #11 NONESSENTIAL	RESOURCE/FLATBED (20), 30;	RESOURCE #30 ESSENTIAL
RESOURCE/TRABIL1 (750), 5;	RESOURCE #12 ESSENTIAL	RESOURCE/FRUSTCAR (50), 36;	RESOURCE #31 NONESSENTIAL
RESOURCE/TRABIL2 (500), 5;	RESOURCE #13 ESSENTIAL	RESOURCE/UASFORK (10), 30;	RESOURCE #32 ESSENTIAL
RESOURCE/TRABIL3 (500), 5;	RESOURCE #14 ESSENTIAL	RESOURCE/JIFORK (10), 33, 34, 35, 32;	RESOURCE #33 ESSENTIAL
RESOURCE/TRABIL4 (500), 5;	RESOURCE #15 ESSENTIAL	RESOURCE/NRCRECT (250), 6;	RESOURCE #34 ESSENTIAL
RESOURCE/TRABIL5 (500), 5;	RESOURCE #16 ESSENTIAL	RESOURCE/NRCAGENT (4), 9;	RESOURCE #35 ESSENTIAL
RESOURCE/PAXTERM (1000), 14;	RESOURCE #17 ESSENTIAL	RESOURCE/NRCTERM (500), 16;	RESOURCE #36 NONESSENTIAL
RESOURCE/PAXAGENT (10), 15;	RESOURCE #18 ESSENTIAL	RESOURCE/TERMFORK (10), 18;	RESOURCE #37 ESSENTIAL
RESOURCE/CARGAGENT (10), 22;	RESOURCE #19 ESSENTIAL		

Figure 62: Resource Statements

waiting time of .8612 hours, or 52 minutes. Referring back to the RESOURCE statements, it is seen that this is the passenger staging area (PAXSTG) file, as well as the feeding for that area (PAXSTGFD). Recalling that the feeding will not keep the FRNs in the file, the user should conclude that the delay was caused by a shortage of staging area (PAXSTG).

Further down the table, minor delays are seen for Files 14 (PAXTERM), 18 (TERMFORK), 23 (WASHRACK), 24 (VEHPROCS), 26 (JITEAM), 28 (WASHRACK again), 31 (JITEAM again), 32 and 33 (both JIFORK). However, all these delays are less than 8 minutes, and at this point should not be of great concern. As a check on this, the user should scan the warning notices which appear in the output before the Summary Report section. If a noticeable number of warnings are seen associated with a particular resource, it could be that a surge has overtaxed that resource for a short period of time, causing a few long delays; or that the resource is just barely large enough to handle a steady workload which frequently overtaxes it, causing many short delays. For instance, File 31 reached a maximum length of 13 FRNs. Even though its average waiting time was less than eight minutes, the length indicates that further review is needed. Plans would need to be developed to deal with the problems revealed by such reviews. If the plans should involve a temporary increase in the resource, a separate

subnetwork would need to be developed which would replicate that increase and the subsequent decrease.

The next major section of the output shows the "Resource Statistics" (Figures 63 and 64). By comparing the "current capacity" and "maximum utilization" figures, the user can detect both under- and over-allocation problems, and can discern symptoms of other problems in the system.

As noted above, the NODEPBIL resource was found to be insufficient. According to the "resource statistics," however, the maximum utilization was 293 out of 350 units available. This happens because the simulation logic will not break up an FRN if the entire group cannot be billeted. Therefore, the user can assume that the next FRN in the 95 that are waiting has more than 57 people in it.

At the passenger reception point, the resource RECPOINT was very close to being exhausted (781 out of 800) at some point, while the INCHECKR was completely utilized (5 out of 5) at least once. Referring back to the INCHECKR file (#4, in Figure 61), the user would see that there was never a delay caused by this resource. Therefore, the INCHECKR is probably at an acceptable level.

On the other hand, the resource PAXSTG is also completely utilized at some point, but its file statistics show a 52 minute average wait. This indicates a serious problem which demands management attention. Possible remedies might include increasing the capacity of the passenger

RESOURCE STATISTICS

RESOURCE NUMBER	RESOURCE LABEL	CURRENT CAPACITY	AVERAGE UTILIZATION	STANDARD DEVIATION	MAXIMUM UTILIZATION	CURRENT UTILIZATION
1	NODEPBIL	350	275.4744	63.7475	293	293
2	RECPOINT	800	47.0065	97.1524	781	0
3	INCHECKR	5	.2992	.5759	5	0
4	BUS	20	.4927	1.4851	17	0
5	PAXSTG	800	349.3123	263.0899	800	0
6	PAXSTGFD	800	349.3123	263.0899	800	0
7	BIL1FEED	750	87.7115	122.3616	652	0
8	BIL2FEED	500	0.0000	0.0000	0	0
9	BIL3FEED	500	0.0000	0.0000	0	0
10	BIL4FEED	500	0.0000	0.0000	0	0
11	BIL5FEED	500	0.0000	0.0000	0	0
12	TRABIL1	750	89.8156	123.5941	652	0
13	TRABIL2	500	0.0000	0.0000	0	0
14	TRABIL3	500	0.0000	0.0000	0	0
15	TRABIL4	500	0.0000	0.0000	0	0
16	TRABIL5	500	0.0000	0.0000	0	0
17	PAXTERN	1000	164.9661	189.2818	984	0
18	PAXAGENT	10	.7902	1.0097	6	0
19	CARGAGNT	10	1.2550	1.3266	8	0
20	WASHRACK	20	1.6869	4.8995	20	0
21	VEHPROCS	50	2.7580	6.7951	50	0
22	VEHPARK	100	33.1765	28.3822	100	0
23	JITEAM	20	3.0439	6.1363	20	0
24	MARSAREA	1000	37.8693	46.3591	342	0
25	UASAREA1	100	12.8822	11.1822	68	0
26	UASAREA2	100	0.0000	0.0000	0	0
27	UASAREA3	100	0.0000	0.0000	0	0
28	UASAREA4	100	0.0000	0.0000	0	0
29	UASAREA5	100	0.0000	0.0000	0	0
30	FLATBED	20	.4052	.8433	8	0
31	FRUSTCAR	50	.0485	.2655	6	0
32	UASFORK	10	.1437	.4666	5	0
33	JIFORK	10	.3181	.9214	10	0
34	NRCRECPT	250	23.1939	35.9823	208	0
35	NRCAGENT	4	.5497	.8159	4	0
36	NRCTERM	500	33.6460	42.4288	222	0
37	TERNFORK	10	.4442	1.9971	10	0

Figure 63: Resource Statistics (Part 1)

RESOURCE NUMBER	RESOURCE LABEL	CURRENT AVAILABLE	AVERAGE AVAILABLE	MINIMUM AVAILABLE	MAXIMUM AVAILABLE
1	NODEPBIL	57	74.5256	57	350
2	RECPOINT	800	752.9935	19	800
3	INCHECKR	5	4.7008	0	5
4	BUS	20	19.5073	3	20
5	PAXSTG	800	450.6877	0	800
6	PAXSTGFD	800	450.6877	0	800
7	BIL1FEED	750	662.2885	98	750
8	BIL2FEED	500	500.0000	500	500
9	BIL3FEED	500	500.0000	500	500
10	BIL4FEED	500	500.0000	500	500
11	BIL5FEED	500	500.0000	500	500
12	TRABIL1	750	660.1844	98	750
13	TRABIL2	500	500.0000	500	500
14	TRABIL3	500	500.0000	500	500
15	TRABIL4	500	500.0000	500	500
16	TRABIL5	500	500.0000	500	500
17	PAXTERM	1000	835.0339	16	1000
18	PAXAGENT	10	9.2098	4	10
19	CARGAGENT	10	8.7450	2	10
20	WASHRACK	20	18.3131	0	20
21	VEHPROCS	50	47.2420	0	50
22	VEHPARK	100	66.8235	0	100
23	JITEAM	20	16.9561	0	20
24	MARSAREA	1000	962.1307	658	1000
25	UASAREA1	100	87.1178	32	100
26	UASAREA2	100	100.0000	100	100
27	UASAREA3	100	100.0000	100	100
28	UASAREA4	100	100.0000	100	100
29	UASAREA5	100	100.0000	100	100
30	FLATBED	20	19.5948	12	20
31	FRUSTCAR	50	49.9515	44	50
32	UASFORK	10	9.8563	5	10
33	JIFORK	10	9.6819	0	10
34	NRCRECPT	250	226.8061	42	250
35	NRCAGENT	4	3.4503	0	4
36	NRCTERM	500	466.3540	278	500
37	TERMFORK	10	9.5558	0	10

Figure 64: Resource Statistics (Part 2)

staging area or changing the timing policy for movement into this area.

Overallocation is demonstrated in several places. The FLATBED and UASFORK resources used to move the pallets out of the unit assembly areas were badly overallocated, with 12 out of 20 FLATBEDs and 5 out of 10 UASFORKs never being used. There is little doubt that such a situation is not desirable. Likewise, four out of the five billeting areas (TRABIL2 through TRABIL5) and four out of five unit assembly areas (UASAREA2 through UASAREA5) were never used. Only part of the capacity established in TRABIL1 and UASAREA1 was utilized. This indicates a waste of resources, which should be rectified in the reception plan. On the other hand, the fact that three of the 20 buses are never used shows the case where management must make a judgement. Since the model does not incorporate provisions for equipment breakdowns, a cushion of three buses might be highly desirable.

Each of the resources should be examined in this manner, looking for both overallocation and underallocation problems. The managers should bear in mind that a "zero-delay" policy is probably not the best policy to pursue. Such a goal would require an inordinate amount of resources to handle the "worst case" situations, and would lead to a very inefficient (though highly effective) operation. A balance should be sought between efficiency and effective-

ness. There is, of course, some risk in doing so, but by using a formal experimental design in operating this model through several replications, the desired level of confidence can be achieved.

To summarize this section, the users should examine each resource and its associated file, keeping in mind the nature of the resource and of the allocation logic. While considerable cross-referencing may be necessary, the information gained makes the effort very worthwhile.

HISTOGRAM OUTPUT (PHASE II)

The final part of the Summary Report is a graphic presentation of the statistics collected on departure variance (the difference between scheduled and actual departure times). These are presented as histograms, which are set up to plot the frequencies in half-hour increments from 1.5 hours early to 3.5 hours late. Following each histogram, tabular statistics are presented.

Three histograms were created, one each for passenger departures, unit cargo departures, and nonunit cargo departures. The passenger histogram (Figure 65), shows that a substantial number of passengers were late in arriving at their aircraft. Only 75% were on time, and the others ranged up to 13.72 hours late (as shown in the tabular statistics). The managers would probably determine that this is unacceptable. Based on the earlier analysis of the

***HISTOGRAM NUMBER 100

PAX DEPART VAR

OBSV FREQ	REL FREQ	CUM FREQ	UPPER CELL LIMIT	0	20	40	60	80	100
0	0.000	0.000	-.1500E+01	+	+	+	+	+	+
0	0.000	0.000	-.1000E+01	+					+
0	0.000	0.000	-.5000E+00	+					+
500	.754	.754	0.	+++++	+++++	+++++	+++++	+++++	+
37	.056	.810	.5000E+00	++++					+
18	.027	.837	.1000E+01	+					+
13	.020	.857	.1500E+01	+					+
16	.024	.881	.2000E+01	+					+
11	.017	.897	.2500E+01	+					+
7	.011	.908	.3000E+01	+					+
6	.009	.917	.3500E+01	+					+
55	.083	1.000	INF	++++					+
---				+	+	+	+	+	+
663				0	20	40	60	80	100

***STATISTICS FOR VARIABLES BASED ON OBSERVATIONS**

PAX DEPART VAR	MEAN VALUE	STANDARD DEVIATION	COEFF. OF VARIATION	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF OBSERVATIONS
	.7076E+00	.1907E+01	.2695E+01	-.3638E-11	.1372E+02	663

Figure 65: Passenger Histogram

resources and files, the most likely bottleneck is the passenger staging area. An increase in this resource would definitely be in order, but such an increase should first be tested with the model to determine that it will in fact solve the problem. By performing the "paper exercise" first, the managers can possibly save time and money by not pursuing ineffective solutions.

The unit cargo histogram (Figure 66), shows that a similar pattern has occurred here, with 14% of the cargo being late. As with the passenger problem above, the resource and file statistics should be examined. In this case, however, there is no obvious cause of the problem. Apparently, the minor delays (less than eight minutes average) are actually the result of a short term surge, which caused a few very late departures. These late departures are too few in number to significantly raise the waiting time statistics, but are significant in the overall performance of the system. This lends support to the questions raised earlier about the 13 FRNs which were backed up at one point in File 31 awaiting joint inspection. This resource (JITEAM) would be a good starting point for further experimentation.

The final histogram, for nonunit cargo (Figure 67), shows a 99% on time rate. This would probably be considered acceptable in most cases. However, this high percentage does not necessarily indicate a perfect system. Due to the

HISTOGRAM NUMBER 218

URC DEPART VAR

OBSV FREQ	RELA FREQ	CUML FREQ	UPPER CELL LIMIT	0	20	40	60	80	100
0	0.000	0.000	-.1500E+01	+	+	+	+	+	+
0	0.000	0.000	-.1000E+01	+					+
0	0.000	0.000	-.5000E+00	+					+
2174	.864	.864	0.	#####	#####	#####	#####	#####	+
39	.015	.879	.5000E+00	##					C
27	.011	.890	.1000E+01	##					C
21	.008	.898	.1500E+01	+					C
38	.015	.913	.2000E+01	##					C
28	.011	.925	.2500E+01	##					C
19	.008	.932	.3000E+01	+					C
19	.008	.940	.3500E+01	+					C
152	.060	1.000	INF	###					C
---				+	+	+	+	+	+
2517				0	20	40	60	80	100

STATISTICS FOR VARIABLES BASED ON OBSERVATIONS

MEAN VALUE	STANDARD DEVIATION	COEFF. OF VARIATION	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF OBSERVATIONS
URC DEPART VAR .4928E+00	.1587E+01	.3220E+01	-.7274E-11	.1157E+02	2517

Figure 66: Unit Cargo Histogram

***HISTOGRAM NUMBER 3**

MRC DEPART VAR

OBSV FREQ	RELA FREQ	CUML FREQ	UPPER CELL LIMIT	0	20	40	60	80	100
0	0.000	0.000	-.1500E+01	+	+	+	+	+	+
0	0.000	0.000	-.1000E+01	+					+
0	0.000	0.000	-.5000E+00	+					+
237	.988	.988	0.	+	+	+	+	+	+
0	0.000	.988	.5000E+00	+					+
1	.004	.992	.1000E+01	+					+
1	.004	.996	.1500E+01	+					+
1	.004	1.000	.2000E+01	+					+
0	0.000	1.000	.2500E+01	+					+
0	0.000	1.000	.3000E+01	+					+
0	0.000	1.000	.3500E+01	+					+
0	0.000	1.000	INF	+					+
---				+	+	+	+	+	+
240				0	20	40	60	80	100

***STATISTICS FOR VARIABLES BASED ON OBSERVATION**

MEAN VALUE	STANDARD DEVIATION	COEFF. OF VARIATION	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF OBSERVATIONS
MRC DEPART VAR .1357E-01	.1294E+00	.9535E+01	-.7276E-11	.1593E+01	240

Figure 67: Nonunit Cargo Histogram

distinction which was drawn between "essential" and "non-essential" resources, and the resulting allocation logic, it is imperative that the managers screen the warning notices (Figure 68) for each of the resources considered nonessential. Recall that when these are exhausted, a notice is printed identifying the shortfall, but the FRN is not kept waiting in the file. Therefore, the files for the nonessential resources will always show zero waiting time. If the resource statistics demonstrate that the maximum availability was not utilized (minimum available greater than zero), there is no cause for concern. However, if that is not the case, it is highly likely that the amount of resource established is actually insufficient and was overflowed at one or more points, as reflected in the warning notices. The segment shown in Figure 68 shows that on day 39 (946 divided by 24), the vehicle parking area was overtaxed several times. The resource statistics in Figure 63 show only that all 100 units were allocated simultaneously at least once. As an aid to the users, the comments imbedded in the RESOURCE statements identify each as either essential or nonessential.

CHAPTER SUMMARY

This chapter has demonstrated the operation of the two models developed in this thesis. Drawing source data from a random-generation routine, a large-scale movement was scheduled through a hypothetical reception system. The resulting output from each of the models was discussed in

FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 943.2983699174
 FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 943.4002695423
 FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 943.7020533294
 FRN HAS NEGATIVE TIME REMAINING UPON FINISH OF
 PAX TERMINAL PROCESSING AT TIME = 943.7404139838
 VEHICLE PARKING OVERFLOW BY 8
 UNITS AT TIME = 946.2807929258
 VEHICLE PARKING OVERFLOW BY 9
 UNITS AT TIME = 946.6107929258
 VEHICLE PARKING OVERFLOW BY 9
 UNITS AT TIME = 948.3736442822
 VEHICLE PARKING OVERFLOW BY 9
 UNITS AT TIME = 949.6851542368
 VEHICLE PARKING OVERFLOW BY 16
 UNITS AT TIME = 951.5647628236
 VEHICLE PARKING OVERFLOW BY 18
 UNITS AT TIME = 951.8947628236
 FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 951.9636542822
 VEHICLE PARKING OVERFLOW BY 9
 UNITS AT TIME = 952.2247628236
 FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 952.6744438795
 VEHICLE PARKING OVERFLOW BY 12
 UNITS AT TIME = 952.8716332614
 FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 954.3551597847
 FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 954.3984108178
 FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 956.467340405
 FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 956.8070543576
 AN FRN IS BEHIND SCHEDULE EXITING THE RECEPTION POINT
 AT TNOW = 956.8792999539
 AN FRN IS BEHIND SCHEDULE EXITING THE RECEPTION POINT
 AT TNOW = 957.0029801657
 FRN HAS NEGATIVE TIME REMAINING UPON FINISH OF
 PAX TERMINAL PROCESSING AT TIME = 957.3644438795
 FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM
 PAX STAGING AREA AT TIME = 958.4413930477
 AN FRN IS BEHIND SCHEDULE EXITING THE RECEPTION POINT
 AT TNOW = 959.3034373706

Figure 68: Warning Messages

detail, with emphasis given to the conclusions which should be drawn from different indicators.

The next (and final) chapter will summarize the findings of this thesis. Since no experimentation with actual data or actual reception systems was performed, these will be confined to the potential for this type of modelling in the war planning environment. Recommendations for future work, both with this particular model and in this general area, will be discussed.

CHAPTER 6

SUMMARY AND RECOMMENDATIONS

INTRODUCTION

Previous chapters have outlined and demonstrated a methodology for CONUS APOE reception planning which uses the powerful tools of computer simulation to capture the complexity of the system being planned. Due to the size and complexity of the system, there was not sufficient time to establish and execute a formal experimental design. Although the research is not complete, several thoughts were developed which will be presented in this chapter.

A brief summary of the major results of this research will be presented first. This will be followed by recommendations which are grouped into two categories. The first category is directed toward future researchers who might wish to carry the modelling exercise further. The second is directed toward policy makers at both base and higher headquarters level.

SUMMARY OF RESULTS

The research statements presented in Chapter 1 proposed that for an APOE with no reception plan, the workload should be determined; and for an APOE with a developed plan, the plan should be tested to determine its capability to meet the workload. These statements led to the develop-

ment of the two models presented in this thesis. A third statement applied the methodology to wartime execution of the plans.

While the methodology was not demonstrated with a real application to an APOE, there is no doubt that it is a workable solution to a very real problem. Real-world applications of the model must be performed in the classified mode, since the TPFDD data is classified. Because the SLAM software at Wright-Patterson AFB is on the Aeronautical Systems Division Cyber computer (which cannot read WWMCCS tapes), special requests had to be made for the war plan data. Since nothing like this had ever been done before, many delays occurred. It is firmly believed that once the data collection procedures are worked out, this process will flow much more smoothly.

As mentioned above, no experimentation was performed with the models. Regardless, valuable results were obtained. These models demonstrated that simulation modelling has a tremendous potential in the war planning community. While different types of models are in use throughout DOD (i.e., war gaming models and MAC's FLOWGEN movement scheduling system), this thesis is the first attempt of its kind in several respects.

First, it uses a commercially available simulation language, which is much less expensive than developing a customized simulation package under contract. Training in

the use of SLAM is also readily available at a large number of universities throughout the country.

Second, these models extract from existing data bases information which is not presented in any other planning documents. As mentioned in Chapter 1, a primary contributor to the managers' problem was the lack of information on how long the people and cargo would be on station. The data have been available, but have never been utilized to derive the needed information as accomplished in this thesis.

Third, these models provide a way to merge data from different sources (i.e., the TPFDD and Reserve Personnel Office data) in order to capture the entire workload, and to combine input from two or more war plans to determine the impact of a simultaneous execution.

Fourth, this methodology can replace the former procedures which required the base-level managers to manually screen the entire TPFDD for their base in an effort to determine the expected workload. By using this modelling methodology, once the reception plan is developed and incorporated into the Phase II model, the managers can determine in a matter of minutes the capability of their system to accommodate any and every workload to be cast against it. All that is required is the TPFDD and other data of interest. As was encountered in this thesis, however, obtaining that data may be difficult until the proper procedures are developed. Once the flow of data is established, the

problems should be minimal.

Finally, the information presented by these models will fill a gaping void in the reception planning process. Prior to this time, there was a possibility that a particular APOE could be scheduled for a workload that far exceeded its capabilities. Furthermore, since the workload screening was done manually, the error might not be caught for quite some time, if at all. Also, even after the error was recognized, the significance would be hard to determine without the tools provided by this thesis. With these tools, every existing and future war plan can be tested for each APOE, resolving the uncertainty which currently exists.

RECOMMENDATIONS

This approach to reception planning is clearly a tremendous leap forward from current procedures. In spite of this, it must be acknowledged that the models developed in this thesis are crude replications of the reception process. Since there was no existing CONUS reception plan on which to base the models, many of the subsystems were aggregated or grossly simplified, and others were left out completely.

In one sense, simulation models are never completed. Regardless of the detail captured in the model, there is always a higher level of resolution which can be sought. The modeller must determine when it is time to stop refin-

ing the model. In this thesis, the primary goal was to establish the framework of the model. Refinement is left to future modellers. The following recommendations, primarily for the Phase II model, are presented as an aid to those future modellers. It is not an exhaustive list, but rather is a starting point. The recommendations are presented in roughly increasing order of difficulty.

There is some work to be done in "cleaning up" the model, especially in the user-written subroutines. Because of the time pressures involved, many rough edges remain. For instance, in earlier versions of the model, Files 12 and 21 were both used. When they were later discarded, there was not time to renumber the other files. Likewise, when the former USERF(15) was discarded, the ones subsequent to it were not renumbered. Also in the subroutines, time could be spent polishing up the FORTRAN coding. In several cases (especially in the allocation and freeing of resources), more efficient methods were applied in the later stages of development. Here again, time pressures dictated that the earlier portions be left unchanged as long as they worked. It was also discovered in the later stages of the Phase II development that several attributes were not being used at all. While deleting them would necessitate corresponding changes throughout the network and subroutines, the gain in processing efficiency would make it worthwhile.

The next area to be considered should involve bringing more detail and refinement to the model. This could be approached in several ways. The resources used in this thesis are by no means complete. For instance, nearly every base has several sizes of buses in addition to the 40 passenger bus used here. The bus allocation routine could be modified to take this into account. Likewise, pallets can be transported on several vehicles other than 40-foot flatbeds. The simplifications and aggregations made throughout the model could be dealt with either through modifications to the network or revision of the subroutines.

In this version of the model, many service and transit times are expressed in the XX(.) array as constants. This was done to allow different APOEs to start using the model without having to modify the network statements. A much better approach would be to either replace those times with values drawn from a random distribution in a USERF function (which, incidently, would achieve the initial goal as well), or insert the distribution directly into the network statements. Such distributions would have to be obtained from the functional managers. Obtaining reasonably accurate data to support the choice of a particular distribution and its parameters represents a time-consuming yet critically important task. Such research will bring the model much closer to reflecting the real-world operation of the system.

In a few places, this version of the model contains opportunities for the user to exercise policy options. It would be most beneficial to increase the number of these options, as that would allow much more efficient reception plan testing. In the same vein, subnetworks could be developed which would incorporate changes in resource availability due to both breakdowns and additional procurement. The model could also incorporate environmental effects such as weather, hostile activity, and changes in the scheduled flow of FRNs both before and after arrival at the APOE.

Several of the simplifications and aggregations were required due to the level of detail in the TPFDD data. Among the grossest involved the determination of the numbers of vehicles and pallets in each FRN. The accuracy of the model would be tremendously enhanced if it could be tied in to the data bases available on the Type Unit Characteristics (TUCHA) and other files. In such an event, the coding in Subroutine EVENT(1) which reads the TPFDD data and assigns the attributes could be modified to determine the type of unit based on the TPFDD code, and then research the TUCHA data to find the exact quantities and type of cargo.

Arrival and departure time estimates were also simplified. As mentioned in earlier chapters, MAC flows each war plan to determine the airlift feasibility, and MTMC performs a similar exercise for their areas of responsibility. If the resulting schedules could be obtained, the

model would no longer have to estimate those times based on a 24-hour window, but could instead estimate them based on a point estimate plus or minus a random variation. Furthermore, if the MAC data included mission number assignments for each FRN, the gross simplification currently present in the cargo departure part of the network could be eliminated. By linking all FRNs with the same mission numbers, the cargo loading process could be included in the model. This would allow what is probably the largest question unanswered by this model - the capabilities of the aerial port loading resources - to be resolved.

As this abbreviated list should indicate, there is an abundance of opportunity for future work in this area. If this work is to be undertaken by thesis research teams, the best approach might be to focus on one area. The first priority should be to clean up the basic framework presented here, especially in the attribute revision and user-written subroutines. Building on that framework, different teams could refine and elaborate different sections of the model. It is strongly recommended, if these efforts are made concurrently, that a single advisor be responsible for insuring that the teams are coordinating their efforts. Otherwise, there is the possibility that the resulting refinements may require extensive revision before they are compatible.

POLICY RECOMMENDATIONS

The problem addressed in this thesis has received attention at every level of command up through and including the Joint Chiefs of Staff (12). Throughout the research which went into the development of Chapters 1 and 2, it was apparent that a major problem was caused by a lack of guidance concerning the basic requirements of reception planning. As was mentioned in Chapter 1, the closest thing to guidance at the current time is contained in AFR 28-4 (Appendix A). This guidance ignores the workload faced by a CONUS APOE dealing with off-base FRNs. Although AFR 28-4 is being rewritten to include this area, it will still leave potential problems unresolved, as it governs only Air Force activities.

The primary policy recommendation of this thesis is that a joint service regulation be written covering the movement of DOD personnel and cargo through Aerial Ports of Embarkation and Debarkation. This is a logical companion to AFR 76-6 which is a joint regulation governing the movement of cargo and passengers on MAC aircraft. Only a joint regulation can adequately assign the responsibilities of both the APOE and the clients which will use it, since a large percentage of those clients will belong to the other services. A joint regulation could also insure that both the clients' and the APOEs' expectations of each other will match up with reality.

This joint regulation should address in detail the responsibilities of both the APOE and the clients which will use it. It should specify the services and facilities which are to be provided by the APOE, as well as the processes involved in moving all types of clients through the system. In this way, the clients will know what to expect when they arrive. There should be clear provision for lines of communication, so that the proper organizations can be notified in advance if either the APOE or the client is unable to fulfill its responsibilities. [An example of such a need occurred recently when an ammunition depot was planning to obtain 463-1 pallets at the APOE, while the APOE was expecting the ammunition to arrive already palletized (24).]

It is recommended that as a general rule, the organizations using an APOE be required to furnish to the APOE planning data showing complete and accurate details of the number of persons and types and amounts of cargo they will be moving (both unit- and nonunit-related). The APOE should then be responsible for all activities necessary to insure timely movement of the clients. This does not mean that the APOE must provide all required labor, prime movers, etc.. The information provided by the clients should show what they can provide in these areas. The APOE is only responsible for making up the difference. As an ancillary recommendation, the requirements posed by this arrangement should be recognized as the basis for manpower and equipment

authorizations.

The previous section on modelling recommendations discussed briefly the enhancements to the model which could be obtained with more precise movement data. It should become the policy of both MAC and MTMC to provide their movement tables to all APOEs. While it is recognized that these pre-execution movement tables would not be used in the actual execution, they still would provide the APOE managers with a reasonable idea of the type of flow which would be developed. Coupled with this model, further benefits could be obtained as previously discussed.

This thesis has demonstrated the power and flexibility of the SLAM II simulation language. The models developed here actually tapped only a fraction of the language's capabilities. The potential for simulation throughout the war planning spectrum cannot be overemphasized. Therefore, it is recommended that the SLAM II software be procured for use on the WWMCCS computers at each MAJCOM headquarters. This would allow each MAJCOM to use models such as these to assess the capabilities of their bases to function in the different scenarios envisioned in the different war plans. By having the SLAM software resident on the WWMCCS computers, the data acquisition problems encountered in this thesis and addressed in Appendix F will not occur, and the operation of such models will be greatly simplified. It is further recommended that after the SLAM software is obtained,

each MAJCOM should establish within the War Plans Directorate a position for one or more trained modellers who could extract the full potential from these tools.

With the SLAM software resident on the WWMCCS systems, the potential use of the Phase III model in an actual execution can be realized. By making adjustments to the subroutines which read in the data, setting the appropriate initialization settings, and obtaining the current flow plan, the real-world operation of the system can be examined for the near future. The potential for such applications was discussed in Chapter 1, and cannot be overemphasized.

CONCLUSION

This thesis has presented a new approach to a problem which currently exists in the war planning community. In developing a solution to that problem, the potential for extensive further research was uncovered. The models presented in this thesis are far from being the final words on the subject of reception system modelling. Rather, they are merely the first steps in the modelling process. Even so, they represent a major leap forward in defining the reception system and planning for its operation.

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A METHODOLOGY FOR CONUS APOE RECEPTION PLANNING(U) AIR
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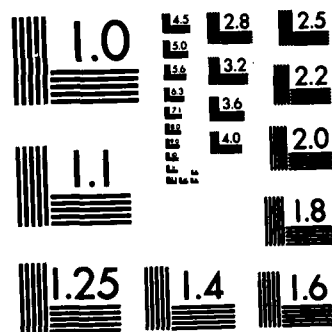
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APPENDICES

APPENDIX A

Reception Planning Requirements (AFR 28-4)

1-1c. Reception Responsibility. MAJCOMs make sure that each base programmed to receive deploying forces, as identified in the WMP-4, has a base reception plan. Reception bases include main operating bases (MOBs), collocated operating bases (COBs), standby bases (SBs), limited bases (LBs) and bare bases (BBs). Plans should include, but are not limited to:

(1) Reception and parking areas to beddown and turn around aircraft deployed to that base, including air-lift and transient aircraft.

(2) Provisions for an aerial port or equivalent to receive and process incoming cargo and passengers.

(3) Provisions for transportation to meet the needs of deployed units

(4) Provisions for billeting, feeding, and laundry services for all deployed personnel.

(5) Facilities and areas to support the deployed units' mobile maintenance, munitions, and supply operations.

(6) Medical care to meet the needs of the deployed force.

(7) Provisions for MAJCOM accountability of incoming personnel.

(8) Provisions for securing arriving aircraft and for using the deployed security police forces.

(9) Provisions for fire protection, crash and rescue support, beddown facilities, utilities, and other civil engineering support required by the deployed forces.

(10) Provision for expanding the existing or integrating the deployed communications - electronics (C-E) assets into the existing systems [23:1-1].

APPENDIX B
PHASE I MODEL

CARD PUNCH ROUTINE

```

001044N
0020$:IDENT:WP1256,XXXC.MAURER 72730
0030$:LIMITS:15,,9K
0040$:OPTION:FORTAN
0050$:FORTY:NDECK
0070      INTEGER PAX,EAD,LAD,BULSTON,OVRSTON,OUTSTON,NAIRST,BULKPOL
0080      CHARACTER FRN*5,ORIGIN*4,POE*4,DEST*4
0085      REWIND 11
0090      READ(11,40) FRN
0100  10      READ(11,50) N,FRN,PAX,BULSTON,OVRSTON,OUTSTON,
0110      +      NAIRST,BULKPOL,ORIGIN,POE,EAD,LAD,DEST
0115      IF(N.EQ.3)GO TO 70
0120      PUNCH 60, FRN,PAX,BULSTON,OVRSTON,OUTSTON,
0130      +      NAIRST,BULKPOL,ORIGIN,POE,EAD,LAD,DEST
0140      GO TO 10
0150  40 FORMAT(A5)
0159  50 FORMAT(11,A5,94X,15,4(17,7X),17,5X,A4,6X,A4,41X,I3,1X,
0160      +      I3,21X,A4)
0170  60 FORMAT(1X,A5,1X,15,1X,5(17,1X),2(A4,1X),2(I3,1X),A4," 2")
0180  70      STOP
0190      END
0200$:EXECUTE
0210$:LIMITS:15,,9K
0220$:TAPE9:11,X2D,,PAH24,,TPFDD
0230
0240$:ENDJOB

```

Note: This routine was created for use on the AFLC
CREATE computer, and may need to be modified
for use on other systems.

PHASE I NETWORK STATEMENTS

100=GEN,LARRY E FORTNER,PHASE I MODEL,6/30/1982;

110=; UPDATE 11 AUGUST 1230 HOURS

120=LIMITS,1,11,2000;

130=PRIORITY,1,LVF(1);

140=RECORD,TNOW,CURRENT TIME,11,P,2.0;

150=;

160=;

170=;

180=VAR,XX(12),M,NONDEPRS,0,1250;

190=VAR,XX(13),S,PAXSTAGNG,0,1250;

200=VAR,XX(14),T,TERMINAL,0,1250;

210=VAR,XX(15),B,TRANSBIL,0,1250;

220=VAR,XX(16),U,UNITCKIN,0,1250;

230=VAR,XX(17),M,NUNTCKIN,0,1250;

240=VAR,XX(18),D,DEPTODAY,0,1250;

250=RECORD,TNOW,CURRENT TIME,12,P,2.0;

260=;

270=VAR,XX(21),0,VEHSTON,0,500;

280=VAR,XX(22),1,NVESTON,0,500;

290=VAR,XX(23),2,BULSTON,0,500;

300=VAR,XX(24),3,OVRSTON,0,500;

310=VAR,XX(25),4,OUTSTON,0,500;

320=VAR,XX(51),5,TOFURCAS,0,500;

330=RECORD,TNOW,CURRENT TIME,13,P,2.0;

340=;

350=;

360=VAR,XX(26),0,VEHSTON,0,500;

370=VAR,XX(27),1,NVESTON,0,500;

380=VAR,XX(28),2,BULSTON,0,500;

390=VAR,XX(29),3,OVRSTON,0,500;

400=VAR,XX(30),4,OUTSTON,0,500;

410=VAR,XX(52),5,TOFNRCCT,0,500;

420=RECORD,TNOW,CURRENT TIME,14,P,2.0;

430=;

440=;

450=VAR,XX(59),0,VEHSTON,0,500;

460=VAR,XX(60),1,NVESTON,0,500;

470=VAR,XX(61),2,BULSTON,0,500;

480=VAR,XX(62),3,OVRSTON,0,500;

490=VAR,XX(63),4,OUTSTON,0,500;

500=VAR,XX(64),5,TONNRCCT,0,500;

510=RECORD,TNOW,CURRENT TIME,19,P,2.0;

520=;

530=;

540=;

550=VAR,XX(51),0,TOFURCAS,0,1000;

560=VAR,XX(52),1,TOFNRCCT,0,1000;

570=VAR,XX(64),2,TONNRCCT,0,1000;

580=VAR,XX(58),3,TOTCARCT,0,1000;

PLOT 1 SHOWS THE NUMBER
OF PERSONNEL IN VARIOUS
AREAS AND THE DAILY
DEPARTURE TOTALS

PLOT 2 SHOWS THE OFFBASE
URC IN THE ASSEMBLY AREA

PLOT 3 SHOWS THE OFFBASE
NRC IN THE AIR CARGO
TERMINAL

PLOT 4 SHOWS THE ONBASE
NRC IN THE AIR CARGO
TERMINAL

PLOT 5 SHOWS THE TOTALS
OF ALL CARGO IN THE
ASSEMBLY AREA AND AIR
CARGO TERMINAL

590=RECORD,TNOW,CURRENT TIME,15,P,2.0;
 600=;
 610=;
 620=;
 630=;
 640=VAR,XX(31),0,VEHSTON,0,1000;
 650=VAR,XX(32),1,NVESTON,0,1000;
 660=VAR,XX(33),2,BULSTON,0,1000;
 670=VAR,XX(34),3,OVRSTON,0,1000;
 680=VAR,XX(35),4,OUTSTON,0,1000;
 690=VAR,XX(57),5,TOTCARMA,0,1000;
 700=VAR,XX(65),0,DEPTODAY,0,1000;
 710=NETWORK;
 720=CRE1 CREATE;
 730=EVT1 EVENT,1;
 740=EVT2 EVENT,2;
 750= ACTIVITY/1,,NNQ(1).GE.1,EVT3;
 760= ACTIVITY/2,ATRI(1),,GON1;
 770=EVT3 EVENT,3;
 780= ACTIVITY/3,ATRI(1),,EVT2;
 790=GON1 GON;
 800= ACTIVITY/4,,ATRI(3).GT.0,GON2;
 810= ACTIVITY/5,,ATRI(4).GT.0,GON3;
 820=;
 830= PASSENGER SUBNETWORK
 840=;
 850=GON2 GON;
 860= ACTIVITY/6,,ATRI(10).EQ.1,AS01;
 870= ACTIVITY/7,,ATRI(10).EQ.2,AS02;
 880= ACTIVITY/8,,ATRI(10).EQ.3,AS10;
 890= ACTIVITY/9,,ATRI(10).EQ.4,AS12;
 900=;
 910= NONDEPLOYERS BILLETING
 920=;
 930=AS01 ASSIGN,XX(12)=XX(12)+ATRI(3);
 940=TER1 TERMINATE;
 950=;
 960= OFFBASE UNIT PERSONNEL RECEPTION POINT
 970=;
 980=AS02 ASSIGN,XX(16)=XX(16)+ATRI(3);
 990= ACTIVITY/10,2.0,,AS03;
 1000=AS03 ASSIGN,XX(16)=XX(16)-ATRI(3);
 1010=AS04 ASSIGN,ATRI(11)=ATRI(2)-TNOW;
 1020= ACTIVITY/11,,ATRI(11).GT.XX(8),AS05;
 1030= ACTIVITY/12,,ATRI(11).LE.XX(8),AS07;
 1040=;
 1050= ENTER TRANSIENT BILLETING
 1060=;
 1070=AS05 ASSIGN,XX(15)=XX(15)+ATRI(3),
 1080= ATRI(11)=ATRI(11)-XX(6);
 1090= ACTIVITY/13,ATRI(11),,AS06;

PLOT 6 SHOWS THE TOTAL
 URC IN THE MARSHALLING
 (CHALKS) AREA AND THE
 DAILY DEPARTURE TOTAL OF
 ALL URC AND NRC

1100=AS06 ASSIGN,XX(15)=XX(15)-ATRI(3),
 1110= ATRI(11)=ATRI(2)-TNOW;
 1120=;
 1130=; ENTER PASSENGER STAGING
 1140=;
 1150=AS07 ASSIGN,XX(13)=XX(13)+ATRI(3),
 1160= ATRI(11)=ATRI(11)-XX(7);
 1170= ACTIVITY/14,ATRI(11),AS08;
 1180=;
 1190=; LEAVE PAI STAGING, ENTER TERMINAL
 1200=;
 1210=AS08 ASSIGN,XX(13)=XX(13)-ATRI(3),
 1220= XX(14)=XX(14)+ATRI(3);
 1230= ACTIVITY/15,XX(7),AS09;
 1240=AS09 ASSIGN,XX(14)=XX(14)-ATRI(3),
 1250= XX(18)=XX(18)+ATRI(3);
 1260=TER2 TERMINATE;
 1270=;
 1280=; OFFBASE NONUNIT PERSONNEL RECEPTION POINT
 1290=;
 1300=AS10 ASSIGN,XX(17)=XX(17)+ATRI(3);
 1310= ACTIVITY/16,2.0,,AS11;
 1320=AS11 ASSIGN,XX(17)=XX(17)-ATRI(3);
 1330= ACTIVITY/17,,,AS04;
 1340=;
 1350=; ONBASE UNIT PERSONNEL, PAISTAGE, TERMINAL
 1360=;
 1370=AS12 ASSIGN,ATRI(11)=ATRI(2)-TNOW;
 1380=AS13 ASSIGN,ATRI(11)=ATRI(11)-XX(7),
 1390= XX(13)=XX(13)+ATRI(3);
 1400= ACTIVITY/18,ATRI(11),AS14;
 1410=AS14 ASSIGN,XX(14)=XX(14)+ATRI(3),
 1420= XX(13)=XX(13)-ATRI(3);
 1430= ACTIVITY/19,XX(7),AS09;
 1440=;
 1450=;
 1460=; CARGO SUBNETWORK
 1470=;
 1480=60N3 GOON;
 1490= ACTIVITY/20,,ATRI(10).EQ.2,AS15;
 1500= ACTIVITY/21,,ATRI(10).EQ.3,AS20;
 1510= ACTIVITY/22,,ATRI(10).EQ.4,AS25;
 1520= ACTIVITY/23,,ATRI(10).EQ.5,AS28;
 1530=;

```

1540=;      URC ASSEMBLY AREA
1550=;
1560=AS15  ASSIGN,XX(21)=XX(21)+ATRIB(5),
1570=      XX(22)=XX(22)+ATRIB(6),
1580=      XX(23)=XX(23)+ATRIB(7),
1590=      XX(24)=XX(24)+ATRIB(8),
1600=      XX(25)=XX(25)+ATRIB(9),
1610=      XX(51)=XX(51)+ATRIB(4);
1620=AS16  ASSIGN,ATRIB(11)=ATRIB(2)-TNOW,
1630=      ATRIB(11)=ATRIB(11)-XX(9);
1640=      ACTIVITY/24,ATRIB(11),,AS17;
1650=AS17  ASSIGN,XX(21)=XX(21)-ATRIB(5),
1660=      XX(22)=XX(22)-ATRIB(6),
1670=      XX(23)=XX(23)-ATRIB(7),
1680=      XX(24)=XX(24)-ATRIB(8),
1690=      XX(25)=XX(25)-ATRIB(9),
1700=      XX(51)=XX(51)-ATRIB(4);
1710=;
1720=;      MARSHALLING AREA
1730=;
1740=AS18  ASSIGN,XX(31)=XX(31)+ATRIB(5),
1750=      XX(32)=XX(32)+ATRIB(6),
1760=      XX(33)=XX(33)+ATRIB(7),
1770=      XX(34)=XX(34)+ATRIB(8),
1780=      XX(35)=XX(35)+ATRIB(9),
1790=      XX(57)=XX(57)+ATRIB(4);
1800=      ACTIVITY/25,XX(9),,AS19;
1810=AS19  ASSIGN,XX(31)=XX(31)-ATRIB(5),
1820=      XX(32)=XX(32)-ATRIB(6),
1830=      XX(33)=XX(33)-ATRIB(7),
1840=      XX(34)=XX(34)-ATRIB(8),
1850=      XX(35)=XX(35)-ATRIB(9),
1860=      XX(57)=XX(57)-ATRIB(4);
1870=AS34  ASSIGN,XX(65)=XX(65)+ATRIB(4);
1880=TER3  TERMINATE;
1890=;
1900=;      OFFBASE NRC TERMINAL
1910=;
1920=AS20  ASSIGN,XX(26)=XX(26)+ATRIB(5),
1930=      XX(27)=XX(27)+ATRIB(6),
1940=      XX(28)=XX(28)+ATRIB(7),
1950=      XX(29)=XX(29)+ATRIB(8),
1960=      XX(30)=XX(30)+ATRIB(9),
1970=      XX(52)=XX(52)+ATRIB(4),
1980=      XX(58)=XX(58)+ATRIB(4);
1990=AS21  ASSIGN,ATRIB(11)=ATRIB(2)-TNOW;
2000=      ACTIVITY/26,ATRIB(11),,AS22;

```

```

2010=AS22  ASSIGN,XX(26)=XX(26)-ATRI(5),
2020=          XX(27)=XX(27)-ATRI(6),
2030=          XX(28)=XX(28)-ATRI(7),
2040=          XX(29)=XX(29)-ATRI(8),
2050=          XX(30)=XX(30)-ATRI(9),
2060=          XX(52)=XX(52)-ATRI(4),
2070=          XX(58)=XX(58)-ATRI(4);
2080=  ACTIVITY/27,,,AS34;
2090=AS25  ASSIGN,ATRI(11)=ATRI(2)-TNOW,
2100=          ATRI(11)=ATRI(11)-XX(9);
2110=  ACTIVITY/28,ATRI(11),,AS18;
2120=;
2130=;  ONBASE NRC TERMINAL
2140=;
2150=AS28  ASSIGN,XX(59)=XX(59)+ATRI(5),
2160=          XX(60)=XX(60)+ATRI(6),
2170=          XX(61)=XX(61)+ATRI(7),
2180=          XX(62)=XX(62)+ATRI(8),
2190=          XX(63)=XX(63)+ATRI(9),
2200=          XX(64)=XX(64)+ATRI(4),
2210=          XX(58)=XX(58)+ATRI(4);
2220=AS29  ASSIGN,ATRI(11)=ATRI(2)-TNOW;
2230=  ACTIVITY/30,ATRI(11),,AS30;
2240=AS30  ASSIGN,XX(59)=XX(59)-ATRI(5),
2250=          XX(60)=XX(60)-ATRI(6),
2260=          XX(61)=XX(61)-ATRI(7),
2270=          XX(62)=XX(62)-ATRI(8),
2280=          XX(63)=XX(63)-ATRI(9),
2290=          XX(64)=XX(64)-ATRI(4),
2300=          XX(58)=XX(58)-ATRI(4);
2310=  ACTIVITY/31,,,AS34;
2320=;
2330=;  TIMING LOOP
2340=;
2350=CRE2  CREATE;
2360=  ACT/32,24.0,,AS33;
2370=AS33  ASSIGN,XX(18)=0.0,
2380=          XX(65)=0.0;
2390=  ACT/33,24.0,,AS33;
2400=  END;
2410=INIT,0,2160;
2420=FIN;
2430=IEND

```

PHASE I SUBROUTINES

```

100=    PROGRAM MAIN (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7)
110=C    FILE NEWSUB2 UPDATE 11 AUGUST 1245 HOURS
120=C*****
130=C
140=C    MAIN PROGRAM IS USED TO INCREASE DIMENSION OF
150=C    NSET/ QSET TO 30000
160=C
170=C
180=    DIMENSION NSET(30000)
190=    COMMON/SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,MSTOP,NCLNR
200=    +,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,SS(100),SSL(100),TNEXT,TNOW,XX(100)
210=    COMMON QSET(30000)
220=    EQUIVALENCE (NSET(1),QSET(1))
230=    NNSET=30000
240=    NCRDR=5
250=    NPRNT=6
260=    NTAPE=7
270=    CALL SLAM
280=    STOP
290=    END
300=C
310=C*****
320=C
330=C    SUBROUTINE EVENT PROCESSES THE TPFDD DATA TO
340=C    A FORM ACCEPTABLE TO THE SIMULATION
350=C
360=    SUBROUTINE EVENT(I)
370=    DIMENSION NSET(30000)
380=    COMMON /SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,
390=    +MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,
400=    +SS(100),SSL(100),TNEXT,TNOW,XX(100)
410=    COMMON QSET(30000)
420=    EQUIVALENCE (NSET(1),QSET(1))
430=    INTEGER NPAX,EAD,LAD,TYPE,J
440=    REAL TOTSTON,VEHSTON,NVESTON,BULSTON,OVRSTON,OUTSTON,A(11)
450=    CHARACTER FRM*5,ORIGIN*4,POE*4,DEST*4
460=C
470=C
480=    GO TO (1,2,3),I

```

```

490=C*****
500=1    CONTINUE
510=C    **THIS EVENT TAKES THE INPUT FROM A FILE AND AFTER THE
520=C      NEEDED MANIPULATIONS ARE DONE INSERTS THE ENTITIES INTO
530=C      SLAM FILE *1. FUTURE REQUIRED THIS PROCEDURE MUST BE MODIFIED
540=C      IN FUTURE *499. ***** TO CHANGE INPUT DATA FORMAT.
550=C
560=C    **THE PROCESS WILL END WHEN ALL RECORDS HAVE BEEN READ.
570=C
580=100  READ(50,50,END=200,ERR=99,IOSTAT=IERR,BULSTON,OVRSTON,OUTSTON,NAIRST,
590=      +   ORIGIN,POE,END,LAD,TEST,TYPE
600=      IF (IERR.NE.0) GO TO 1999,ERR=999,IOSTAT=IERR,BULSTON,OVRSTON,OUTSTON,NAIRST,
610=      +   ORIGIN,POE,END,LAD,TEST,TYPE
620=50   FORMAT(1X,A5,1X,I5,4(1X,F7.0),2(1X,A4),2(1X,I3),1X,A4,1X,I1)
630=      J=1
640=C    **ATRI(2) IS THE EXPECTED DEPARTURE TIME, XX(3) = FLIGHT TIME
650=      XX(4) = (EAD * 24.0) - XX(3) - 24.0
660=      XX(5) = (LAD * 24.0) - XX(3)
670=      A(2) = UNFRM(XX(4),XX(5),1)
680=C
690=C    **ATRI(3) IS THE NUMBER OF PASSENGERS
700=      A(3) = NPAX
710=C
720=C    **ATRI(4) IS THE TOTAL STONS OF CARGO
730=      A(4) = .10 * (BULSTON + OVRSTON + OUTSTON)
740=C
750=C    **ATRI(7) IS THE BULK STON AMOUNT
760=      A(7) = BULSTON * .10
770=C
780=C    **ATRI(8) IS THE OVERSIZE STON AMOUNT
790=      A(8) = OVRSTON * .10
800=C
810=C    **ATRI(9) IS THE OUTSIZE STON AMOUNT
820=      A(9) = OUTSTON * .10
830=C
840=C    **ATRI(10) IS THE TYPE OF UNIT
850=C      'ZHTV' IS THE GEOLOC CODE FOR WPAFB.
860=      IF (DEST.EQ.'ZHTV') A(10) = 1
870=      IF (TYPE.EQ.2.AND.DEST.NE.'ZHTV'.AND.ORIGIN.NE.'ZHTV') A(10)=2
880=      IF (TYPE.EQ.3.AND.DEST.NE.'ZHTV'.AND.ORIGIN.NE.'ZHTV') A(10)=3
890=      IF (TYPE.EQ.2.AND.DEST.NE.'ZHTV'.AND.ORIGIN.EQ.'ZHTV') A(10)=4
900=      IF (TYPE.EQ.3.AND.DEST.NE.'ZHTV'.AND.ORIGIN.EQ.'ZHTV') A(10)=5
910=C
920=C    **ATRI(5) IS THE VEHICULAR STON ESTIMATE
930=      IF(A(10).EQ.2.OR.A(10).EQ.4) A(5) = .8 * A(4)
940=      IF(A(10).EQ.3.OR.A(10).EQ.5) A(5) = .1 * A(4)
950=      IF(A(10).EQ.1) A(5) = 0.0
960=C
970=C    **ATRI(6) IS THE NON-VEHICULAR STON ESTIMATE
980=      A(6) = A(4) - A(5)
990=C

```

```

1000=C      **ATRIB(1) IS THE ARRIVAL TIME AT THE APDE. AND IS BASED
1010=C      ON THE TYPE OF UNIT AND OTHER AVAILABLE PARAMETERS.
1020=      IF (A(10).EQ.1) THEN
1030=          A(1) = A(2) + XX(3)
1040=      ELSE IF (A(10).EQ.2.OR.A(10).EQ.3) THEN
1050=          XX(1) = A(2)-36.0
1060=          XX(2) = A(2)-24.0
1070=          XX(10) = A(2)-12.0
1080=150      A(1) = TRIAG(XX(1),XX(2),XX(10),2)
1090=          IF(A(1).LT.0.0) THEN
1100=              IF(J.GT.10) GO TO 160
1110=              J=J+1
1120=              GO TO 150
1130=          END IF
1140=160      IF (J.GT.10) A(1) = 0.0
1150=      ELSE
1160=          A(1) = A(2)-XX(7)-XX(19)
1170=          IF (A(1).LT.0) A(1) = 0.0
1180=      END IF
1190=C      **ATRIB(11) IS SET TO 0, IS LATER DEFINED IN THE NETWORK
1200=      A(11) = 0
1210=C
1220=C
1230=C      **THE NEXT FEW LINES SCREEN FOR PROBLEMS
1240=      IF (NAIRST.GT.0) PRINT*, 'NON-AIRLIFT CARGO IN FRN # ',FRN
1250=C
1260=C
1270=C      **THE TRACE, IF ACTIVATED BY XX(99)=1, WILL PRINT THE ARRAY
1280=      IF (XX(99).EQ.1) PRINT 170,FRN,A(1),A(2),A(3),A(4),A(5),A(6),
1290=      +      A(7),A(8),A(9),A(10),A(11)
1300=170      FORMAT(1X,A5,9(1X,F6.2),1X,F1.0,1X,F2.1)
1310=C
1320=C
1330=C      **WITH ALL ATRIBUTES DEFINED, THE ENTITY IS FILED AWAY
1340=      CALL FILEM(1,A)
1350=C
1360=C      **RETURN TO DO THE NEXT ENTITY
1370=      GO TO 100
1380=C
1390=C      **END OF FILE TRIGGERS 200
1400=200      RETURN
1410=C
1420=C

```

```

1430=C*****
1440=C      **EVENT 2 PULLS THE ENTITIES OUT OF FILE 1 AS THEIR ARRIVAL TIMES
1450=C      APPROACH. FILE 1 IS RANKED LVF ON ATRIB(1), THE ARRIVAL TIME
1460=C
1470=2      IF(NNQ(1).EQ.0) RETURN
1480=      CALL ABOVE(1,1,ATRIB)
1490=C
1500=C      **THE TIME REMAINING TO ARRIVAL IS COMPUTED AND PLACED INTO
1510=C      ATRIB(1), AND USED AS THE DURATION OF THE LEADIN ACTIVITY
1520=      ATRIB(1) = ATRIB(1) - TNOW
1530=      RETURN
1540=C
1550=C*****
1560=C      **THE NEW FIRST ENTITY'S ATRIBUTES ARE COPIED INTO ATRIB
1570=C      SO WE CAN DETERMINE HOW LONG BEFORE IT WILL ARRIVE
1580=3      IF(NNQ(1).EQ.0) RETURN
1590=      CALL COPY(1,1,ATRIB)
1600=      ATRIB(1) = ATRIB(1) - TNOW
1610=      RETURN
1620=      END
1630=C
1640=C
1650=C*****
1660=C      SUBROUTINE INTLC INITIALIZES THE XX(.) ARRAY
1670=C      TO 0.0, THEN SETS CERTAIN VARIABLES TO USER-
1680=C      DEFINED VALUES
1690=C
1700=C
1710=      SUBROUTINE INTLC
1720=      DIMENSION NSET(30000)
1730=      COMMON /SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,NFA,
1740=      +MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NNSET,NTAPE,
1750=      +SS(100),SSL(100),TNEXT,TNOW,XX(100)
1760=      COMMON QSET(30000)
1770=      EQUIVALENCE (NSET(1),QSET(1))
1780=C
1790=C      **THE ENTIRE XX(.) ARRAY IS FIRST SET TO 0.0**
1800=C
1810=      DO 10 I=1,100
1820=          XX(I) = 0.0
1830=10      CONTINUE
1840=C

```



```

1850=C      **THEN CERTAIN VARIABLES ARE SET TO USER- DEFINED VALUES**
1860=C
1870=C      ** XX(3) = FLIGHT TIME TO THE COMBAT THEATER
1880=C      ** XX(6) = HOW LONG BEFORE DEPARTURE TO LEAVE
1890=C      TRANSIENT BILLETING
1900=C      ** XX(7) = HOW LONG BEFORE DEPARTURE TO BE IN
1910=C      THE PAX TERMINAL PROCESSING AREA
1920=C      ** XX(8) = TIME NEEDED BEFORE DEPARTURE TO JUSTIFY
1930=C      ** TRANSIENT BILLETING
1940=C      ** XX(9) = TIME BEFORE DEPARTURE CARGO MUST ENTER
1950=C      ** MARSHALLING AREA, INCLUDING TIME NEEDED
1960=C      ** FOR INSPECTION
1970=C      ** XI(19) = THE MINIMUM TIME ONBASE PERSONNEL MUST
1980=C      ** SPEND IN PAX STAGING
1990=C      ** XI(99) = TRACE SWITCH, 0=OFF, 1=ON
2000=C
2010=C      ** ALL OTHER VARIABLES ARE INITIALLY SET TO 0.0
2020=C
2030=      XI(3) = 8.5
2040=      XI(6) = 6.0
2050=      XI(7) = 2.0
2060=      XI(8) = 18.0
2070=      XI(9) = 4.0
2080=      XI(19) = 4.0
2090=      XI(99) = 1
2100=      RETURN
2110=      END
2120=EDR

```

APPENDIX C
VARIABLE AND ATTRIBUTE DEFINITIONS

TABLE 1

XX(.) VARIABLE DEFINITIONS

PHASE I

Any variable not listed is not used in Phase I.

XX(1) = Utility (EVENT(1))
 XX(2) = Utility (EVENT(1))
 XX(3) = Flight Time to Combat Theater
 XX(4) = Utility (EVENT(1))
 XX(5) = Utility (EVENT(1))
 XX(6) = # Hours Before Departure to Vacate Transient
 Billeting
 XX(7) = # Hours Before Departure to Enter Pax Terminal
 XX(8) = Time Needed to Justify Billeting
 XX(9) = # Hours Before Departure to Enter Marshalling Area
 XX(10) = Utility (EVENT(1))
 XX(12) = Current Non-Deploying Personnel Population
 XX(13) = Current Pax Staging Population
 XX(14) = Current Pax Terminal Population
 XX(15) = Current Transient Billeting Population
 XX(16) = Current Unit Reception Point Population
 XX(17) = Current Nonunit Reception Point Population
 XX(18) = Daily Pax Departure Total
 XX(19) = Minimum Time to Spend in Pax Staging
 XX(21) - (25) are Off-Base URC Assembly Area Tonnages
 (21) = Vehicular
 (22) = Nonvehicular
 (23) = Bulk
 (24) = Oversize
 (25) = Outsize
 XX(26) - (30) are Off-Base NRC Terminal Tonnages
 (26) = Vehicular
 (27) = Nonvehicular
 (28) = Bulk
 (29) = Oversize
 (30) = Outsize
 XX(31) - (35) are Total (On- and Off-Base) URC Marshalling
 Area Tonnages
 (31) = Vehicular
 (32) = Nonvehicular
 (33) = Bulk
 (34) = Oversize
 (35) = Outsize

XX(51) = Total Off-Base URC/Assembly Area
 XX(52) = Total Off-Base NRC/Terminal
 XX(57) = Total Cargo in Marshalling Area
 XX(58) = Total Cargo in Terminal
 XX(59) - (63) are On-Base NRC Terminal Tonnages
 (59) = Vehicular
 (60) = Nonvehicular
 (61) = Bulk
 (62) = Oversize
 (63) = Outsize
 XX(64) = Total On-Base NRC/Terminal
 XX(65) = Daily Cargo Departure Total
 XX(99) = Trace Switch

PHASE II

Any variable not listed is not used in Phase II.

XX(1) = Utility (EVENT(1))
 XX(2) = Utility (EVENT(1))
 XX(3) = Flight Time to Combat Theater
 XX(4) = Utility (EVENT(1))
 XX(5) = Utility (EVENT(1))
 XX(6) = # Hours Before Departure to Vacate Transient
 Billeting
 XX(7) = # Hours Before Departure that On-Base Pax will go to
 the Pax Staging Area, On-Base Vehicular URC will go
 to the Vehicle Processing Area and On-Base NRC will
 go to the Cargo Terminal.
 XX(8) = Time Needed to Justify Billeting
 XX(9) = # Hours Before Departure to Enter Marshalling Area
 XX(21) = The Type Transport RECPOINT to TRABIL1
 XX(22) = The Type Transport RECPOINT to TRABIL2
 XX(23) = The Type Transport RECPOINT to TRABIL3
 XX(24) = The Type Transport RECPOINT to TRABIL4
 XX(25) = The Type Transport RECPOINT to TRABIL5
 XX(26) = Transit Duration RECPOINT to TRABIL1
 XX(27) = Transit Duration RECPOINT to TRABIL2
 XX(28) = Transit Duration RECPOINT to TRABIL3
 XX(29) = Transit Duration RECPOINT to TRABIL4
 XX(30) = Transit Duration RECPOINT to TRABIL5
 XX(31) = The Type Transport TRABIL1 to Pax Staging
 XX(32) = The Type Transport TRABIL2 to Pax Staging
 XX(33) = The Type Transport TRABIL3 to Pax Staging
 XX(34) = The Type Transport TRABIL4 to Pax Staging
 XX(35) = The Type Transport TRABIL5 to Pax Staging
 XX(36) = Transit Duration TRABIL1 to Pax Staging
 XX(37) = Transit Duration TRABIL2 to Pax Staging
 XX(38) = Transit Duration TRABIL3 to Pax Staging
 XX(39) = Transit Duration TRABIL4 to Pax Staging
 XX(40) = Transit Duration TRABIL5 to Pax Staging

XX(41) = The Type Transport RECPOINT to Pax Staging
 XX(42) = Transit Duration RECPOINT to Pax Staging
 XX(43) = Type Transport to Pax Staging Terminal
 XX(44) = Transit Duration Pax Staging to Terminal
 XX(45) = Earliest Time before Departure FRNs will Move to Terminal
 XX(46) = Percent of Aircraft Parking Spots within Walking Distance of the Terminal
 XX(47) = Round Trip Transit Time to Aircraft Via Bus
 XX(49) = Transit Duration Terminal to Aircraft Via Foot
 XX(50) = Type Transport Mobility Line to Pax Staging
 XX(51) = Transit Duration Mobility Line to Pax Staging
 XX(52) = Vehicular Tonnage Estimator Switch
 XX(53) = Average Vehicle Weight
 XX(54) = Average Pallet Weight
 XX(55) = Average Vehicle Wash Time
 XX(56) = Vehicle Transit Time Reception Point to Washrack
 XX(57) = Vehicle Transit Time Washrack to Vehicle Processing Area
 XX(58) = Vehicle Processing Time (excluding washing)
 XX(59) = Transit Time Vehicle Processing to Joint Inspection
 XX(60) = Probability of Failing Joint Inspection
 XX(62) = Percent of Vehicle Failures Due to Processing Problems Other than Incorrect Washing
 XX(63) = Transit Time Joint Inspection to Washrack
 XX(64) = Earliest Time to Report to Joint Inspection
 XX(65) = Transit Time from Vehicle Processing to V Parking
 XX(66) = Transit Time Vehicle Parking Joint Inspection
 XX(67) = Transit Time UASAREA1 to Joint Inspection
 XX(68) = Transit Time UASAREA2 to Joint Inspection
 XX(69) = Transit Time UASAREA3 to Joint Inspection
 XX(70) = Transit Time UASAREA4 to Joint Inspection
 XX(71) = Transit Time UASAREA5 to Joint Inspection
 XX(72) = Transit Time Joint Inspection to Frustrated Pallet Processing
 XX(73) = Transit Time (pallets) Joint Inspection to Marshalling Area
 XX(74) = Transit Time (vehicles) Joint Inspection to Marshalling Area
 XX(75) = Transit Time NRC Reception Point to NRC Terminal
 XX(76) = NRC Processing Switch
 XX(77) = Time for Terminal Forklift to Unload One Pallet
 XX(95) = Utility (EVENT(2))
 XX(99) = Trace Switch

TABLE 2

ATTRIBUTE DEFINITIONS

PHASE I

ATRIB(1) = Scheduled Arrival Time at APOE
 ATRIB(2) = Scheduled Departure Time from APOE
 ATRIB(3) = Number of Passengers
 ATRIB(4) = Total Short Tons of Cargo
 ATRIB(5) = Vehicular Short Ton Estimate
 ATRIB(6) = Nonvehicular Short Ton Estimate
 ATRIB(7) = Bulk Short Tons
 ATRIB(8) = Oversize Short Tons
 ATRIB(9) = Outsize Short Tons
 ATRIB(10) = Type of Unit
 ATRIB(11) = Variable¹

PHASE II

ATRIB(1) = Scheduled Arrival Time at APOE
 ATRIB(2) = Scheduled Departure Time from APOE
 ATRIB(3) = Variable¹
 ATRIB(4) = Variable¹
 ATRIB(5) = Variable¹
 ATRIB(6) = Variable¹
 ATRIB(7) - (9) Not Used
 ATRIB(10) = Type of Unit
 ATRIB(11) = Variable¹
 ATRIB(12) = Variable¹
 ATRIB(13) = Variable¹
 ATRIB(14) = Variable¹
 ATRIB(15) = Variable¹
 ATRIB(16) = Variable¹
 ATRIB(17) = Units of Resource Needed by This FRN
 ATRIB(18) = Units of Resource Held by This FRN

¹These attributes are redefined in several places within the networks. To determine their definition at a certain point, refer to the appropriate sections of Chapter 3 or 4.

APPENDIX D
PHASE II MODEL

PHASE II NETWORK STATEMENTS

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100=GEN,LARRY E. FORTNER,PHASE II MODEL,8/7/1982;
110=; TESTPH2 UPDATE 29 AUG 1222 HOURS
120=LIMITS,36,18,1100;
130=PRIORITY/1,LVF(1)/2,LVF(2)/3,LVF(2)/4,LVF(2)/5,LVF(2)/6,LVF(2)/;
140=PRIORITY/7,LVF(2)/8,LVF(2)/9,LVF(2)/10,LVF(2)/11,LVF(2)/;
150=PRIORITY/12,LVF(2)/13,LVF(2)/14,LVF(2)/15,LVF(2)/16,LVF(2)/;
160=PRIORITY/17,LVF(2)/18,LVF(2)/19,LVF(2)/20,LVF(2)/21,LVF(2)/;
170=PRIORITY/22,LVF(2)/23,LVF(2)/24,LVF(2)/25,LVF(2)/26,LVF(2)/;
180=PRIORITY/27,LVF(2)/28,LVF(2)/29,LVF(2)/30,LVF(2)/31,LVF(2)/;
190=PRIORITY/32,LVF(2)/33,LVF(2)/34,LVF(2)/35,LVF(2)/36,LVF(2)/;
200=NETWORK;
210= RESOURCE/NODEPBIL(350),2; RESOURCE #1
220=; ESSENTIAL
230= RESOURCE/RECPDINT(800),3; RESOURCE #2
240=; ESSENTIAL
250= RESOURCE/INCHECKR(5),4; RESOURCE #3
260=; ESSENTIAL
270= RESOURCE/BUS(20),17,13,10,19,20,7; RESOURCE #4
280=; ESSENTIAL
290= RESOURCE/PAXSTG(800),11; RESOURCE #5
300=; ESSENTIAL
310= RESOURCE/PAXSTGFD(800),11; RESOURCE #6
320=; NONESSENTIAL
330= RESOURCE/BIL1FEED(750),8; RESOURCE #7
340=; NONESSENTIAL
350= RESOURCE/BIL2FEED(500),8; RESOURCE #8
360=; NONESSENTIAL
370= RESOURCE/BIL3FEED(500),8; RESOURCE #9
380=; NONESSENTIAL
390= RESOURCE/BIL4FEED(500),8; RESOURCE #10
400=; NONESSENTIAL
410= RESOURCE/BIL5FEED(500),8; RESOURCE #11
420=; NONESSENTIAL
430= RESOURCE/TRABIL1(750),5; RESOURCE #12
440=; ESSENTIAL
450= RESOURCE/TRABIL2(500),5; RESOURCE #13
460=; ESSENTIAL
470= RESOURCE/TRABIL3(500),5; RESOURCE #14
480=; ESSENTIAL
490= RESOURCE/TRABIL4(500),5; RESOURCE #15
500=; ESSENTIAL
510= RESOURCE/TRABIL5(500),5; RESOURCE #16
520=; ESSENTIAL
530= RESOURCE/PAXTERM(1000),14; RESOURCE #17
540=; ESSENTIAL

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550=	RESOURCE/PAXAGENT(10),15;	RESOURCE #18
560=;		ESSENTIAL
570=	RESOURCE/CARGAGENT(10),22;	RESOURCE #19
580=;		ESSENTIAL
590=	RESOURCE/WASHRACK(20),28,23;	RESOURCE #20
600=;		ESSENTIAL
610=	RESOURCE/VEHPROCS(50),24;	RESOURCE #21
620=;		ESSENTIAL
630=	RESOURCE/VEHPARK(100),25;	RESOURCE #22
640=;		NONESSENTIAL
650=	RESOURCE/JITEAM(20),26,31;	RESOURCE #23
660=;		ESSENTIAL
670=	RESOURCE/MARSAREA(1000),27;	RESOURCE #24
680=;		NONESSENTIAL
690=	RESOURCE/UASAREA1(100),29;	RESOURCE #25
700=;		ESSENTIAL
710=	RESOURCE/UASAREA2(100),29;	RESOURCE #26
720=;		ESSENTIAL
730=	RESOURCE/UASAREA3(100),29;	RESOURCE #27
740=;		ESSENTIAL
750=	RESOURCE/UASAREA4(100),29;	RESOURCE #28
760=;		ESSENTIAL
770=	RESOURCE/UASAREA5(100),29;	RESOURCE #29
780=;		ESSENTIAL
790=	RESOURCE/FLATBED(20),30;	RESOURCE #30
800=;		ESSENTIAL
810=	RESOURCE/FRUSTCAR(50),36;	RESOURCE #31
820=;		NONESSENTIAL
830=	RESOURCE/UASFORK(10),30;	RESOURCE #32
840=;		ESSENTIAL
850=	RESOURCE/JIFORK(10),33,34,35,32;	RESOURCE #33
860=;		ESSENTIAL
870=	RESOURCE/NRCRECP(250),6;	RESOURCE #34
880=;		ESSENTIAL
890=	RESOURCE/NRCAGENT(4),9;	RESOURCE #35
900=;		ESSENTIAL
910=	RESOURCE/NRCTERM(500),16;	RESOURCE #36
920=;		NONESSENTIAL
930=	RESOURCE/TERNFORK(10),18;	RESOURCE #37
940=;		ESSENTIAL
950=CR01	CREATE;	
960=;		
970=;	EVENT(10) GENERATES A SAMPLE OF 1000 FRMS FOR DEMONSTRATION	
980=;	PURPOSES AND SHOULD BE DELETED IN REAL-WORLD USE OF THE MODEL.	
990=;		
1000=EVT	EVENT,10;	
1010=EV01	EVENT,1;	
1020=EV02	EVENT,2;	
1030=	ACT,,NNQ(1),GE.1,EV03;	
1040=	ACT,ATRIB(1),,GN01;	
1050=EV03	EVENT,3;	

1060= ACT, ATRIB(1),,EV02;
 1070=GN01 GOON;
 1080= ACT,, ATRIB(3).GT.0,GN02;
 1090= ACT,, ATRIB(4).GT.0,GN05;
 1100=; PASSENGER SUBNETWORK
 1110=GN02 GOON;
 1120= ACT,, ATRIB(10).EQ.1,AW01;
 1130= ACT,, ATRIB(10).EQ.2.OR. ATRIB(10).EQ.3,AW02;
 1140= ACT,, ATRIB(10).EQ.4.OR. ATRIB(10).EQ.5,GN03;
 1150=;
 1160=; NONDEPLOYING PERSONNEL BRANCH
 1170=AW01 AWAIT(2),NODEPBIL/ ATRIB(3);
 1180=TR01 TERM;
 1190=;
 1200=; OFFBASE DEPLOYING PERSONNEL BRANCH
 1210=AW02 AWAIT(3),RECPOINT/ ATRIB(3);
 1220=AW03 AWAIT(4),INCHECKR/1;
 1230= ACT,USERF(1);
 1240=FR01 FREE, INCHECKR/1;
 1250=AS01 ASSIGN, ATRIB(11)=USERF(2), ATRIB(17)=USERF(11);
 1260= ACT,, ATRIB(11).LE.XX(8).AND.XX(41).EQ.0,FR23;
 1270= ACT,, ATRIB(11).LE.XX(8).AND.XX(41).EQ.1,AW13;
 1280= ACT,, ATRIB(11).GT.XX(8),AW04;
 1290=;
 1300=; BRANCH IF WALKING TO PAX STAGING
 1310=FR23 FREE,RECPOINT/ ATRIB(3);
 1320= ACT,IX(42),,AW08;
 1330=;
 1340=; BRANCH IF RIDING BUS TO PAX STAGING
 1350=AW13 AWAIT(19),ALLOC(2);
 1360= ACT,, ATRIB(17).GT.0,AW13;
 1370= ACT,XX(42), ATRIB(17).GT.0,FR24;
 1380= ACT,, ATRIB(17).EQ.0,FR25;
 1390=FR24 FREE,BUS/ ATRIB(18);
 1400=TR02 TERM;
 1410=FR25 FREE,RECPOINT/ ATRIB(3);
 1420= ACT,IX(42);
 1430=FR26 FREE,BUS/ ATRIB(18);
 1440= ACT,,AW08;
 1450=;
 1460=; BRANCH INTO TRANSIENT BILLETING
 1470=AW04 AWAIT(5),ALLOC(1);
 1480= ACT,, ATRIB(11).LE.XX(8),AS01;
 1490= ACT,, ATRIB(11).GT.XX(8),GN04;

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1500=GN04  GOODN;
1510=  ACT,, ATRIB(12).GT.0.AND.XX(21).EQ.0,FR02;
1520=  ACT,, ATRIB(13).GT.0.AND.XX(22).EQ.0,FR03;
1530=  ACT,, ATRIB(14).GT.0.AND.XX(23).EQ.0,FR04;
1540=  ACT,, ATRIB(15).GT.0.AND.XX(24).EQ.0,FR05;
1550=  ACT,, ATRIB(16).GT.0.AND.XX(25).EQ.0,FR06;
1560=  ACT,, ATRIB(12).GT.0.AND.XX(21).EQ.1,AS03;
1570=  ACT,, ATRIB(13).GT.0.AND.XX(22).EQ.1,AS05;
1580=  ACT,, ATRIB(14).GT.0.AND.XX(23).EQ.1,AS07;
1590=  ACT,, ATRIB(15).GT.0.AND.XX(24).EQ.1,AS09;
1600=  ACT,, ATRIB(16).GT.0.AND.XX(25).EQ.1,AS11;
1610=;
1620=;  MOVE TO BILLETING AREA(S)- FIRST IF BY FOOT
1630=;
1640=;  AREA 1
1650=FR02  FREE,RECPOINT/ATRIB(12);
1660=AS02  ASSIGN,ATRIB(13)=0,ATRIB(14)=0,ATRIB(15)=0,ATRIB(16)=0;
1670=  ACT,XX(26),,AW06;
1680=;
1690=;  AREA 2
1700=FR03  FREE,RECPOINT/ATRIB(13);
1710=AS04  ASSIGN,ATRIB(12)=0,ATRIB(14)=0,ATRIB(15)=0,ATRIB(16)=0;
1720=  ACT,XX(27),,AW06;
1730=;
1740=;  AREA 3
1750=FR04  FREE,RECPOINT/ATRIB(14);
1760=AS06  ASSIGN,ATRIB(12)=0,ATRIB(13)=0,ATRIB(15)=0,ATRIB(16)=0;
1770=  ACT,XX(28),,AW06;
1780=;
1790=;  AREA 4
1800=FR05  FREE,RECPOINT/ATRIB(15);
1810=AS08  ASSIGN,ATRIB(12)=0,ATRIB(13)=0,ATRIB(14)=0,ATRIB(16)=0;
1820=  ACT,XX(29),,AW06;
1830=;
1840=;  AREA 5
1850=FR06  FREE,RECPOINT/ATRIB(16);
1860=AS10  ASSIGN,ATRIB(12)=0,ATRIB(13)=0,ATRIB(14)=0,ATRIB(15)=0;
1870=  ACT,XX(30),,AW06;
1880=;
1890=;  BUS ROUTING TO BILLET AREAS
1900=;
1910=;  AREA 1
1920=AS03  ASSIGN,ATRIB(13)=0,ATRIB(14)=0,ATRIB(15)=0,ATRIB(16)=0,
1930=      ATRIB(17)=USERF(3);
1940=  ACT,,,AW05;
1950=;
1960=;  AREA 2
1970=AS05  ASSIGN,ATRIB(12)=0,ATRIB(14)=0,ATRIB(15)=0,ATRIB(16)=0,
1980=      ATRIB(17)=USERF(4);
1990=  ACT,,,AW05;
2000=;

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2010=; AREA 3
 2020=AS07 ASSIGN, ATRIB(12)=0, ATRIB(13)=0, ATRIB(15)=0, ATRIB(16)=0,
 2030= ATRIB(17)=USERF(5);
 2040= ACT,,,AM05;
 2050=;
 2060=; AREA 4
 2070=AS09 ASSIGN, ATRIB(12)=0, ATRIB(13)=0, ATRIB(14)=0, ATRIB(16)=0,
 2080= ATRIB(17)=USERF(6);
 2090= ACT,,,AM05;
 2100=;
 2110=; AREA 5
 2120=AS11 ASSIGN, ATRIB(12)=0, ATRIB(13)=0, ATRIB(14)=0, ATRIB(15)=0,
 2130= ATRIB(17)=USERF(7);
 2140= ACT,,,AM05;
 2150=;
 2160=AM05 AWAIT(7), ALLOC(2);
 2170= ACT,, ATRIB(17).GT.0, AM05;
 2180= ACT, USERF(13), ATRIB(17).GT.0, FR07;
 2190= ACT,, ATRIB(17).EQ.0, EV04;
 2200=;
 2210=FR07 FREE, BUS/ATRIB(18);
 2220=TR03 TERM;
 2230=;
 2240=EV04 EVENT, 4;
 2250= ACT, USERF(13);
 2260=FR08 FREE, BUS/ATRIB(18);
 2270=;
 2280=; NOW IN THE BILLETING AREA(S), ALLOCATE FEEDING
 2290=AM06 AWAIT(8), ALLOC(3);
 2300= ACT, USERF(8);
 2310=EV05 EVENT, 5, 1;
 2320=;
 2330=; READY TO LEAVE BILLET AREA(S)- FIRST IF BY FOOT
 2340= ACT,, ATRIB(12).GT.0.AND.XX(31).EQ.0, FR09;
 2350= ACT,, ATRIB(13).GT.0.AND.XX(32).EQ.0, FR10;
 2360= ACT,, ATRIB(14).GT.0.AND.XX(33).EQ.0, FR11;
 2370= ACT,, ATRIB(15).GT.0.AND.XX(34).EQ.0, FR12;
 2380= ACT,, ATRIB(16).GT.0.AND.XX(35).EQ.0, FR13;
 2390=;
 2400=; THEN IF BY BUS
 2410= ACT,,,AM07;
 2420=;
 2430=; WALKERS PASS THROUGH THESE NODES
 2440=;
 2450=FR09 FREE, TRABIL1/ATRIB(12);
 2460= ACT, XX(36),, AM08;
 2470=;
 2480=FR10 FREE, TRABIL2/ATRIB(13);
 2490= ACT, XX(37),, AM08;
 2500=;

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2540=FR11 FREE,TRABIL4/ATRIB(14);
2550= ACT,XX(38),,AM08;
2560=;
2570=FR12 FREE,TRABIL4/ATRIB(15);
2580= ACT,XX(39),,AM08;
2590=;
2600=FR13 FREE,TRABIL5/ATRIB(16);
2610= ACT,XX(40),,AM08;
2620=;
2630= RIDERS MUST AWAIT BUSES
2640=;
2650=AW07 AWAIT(10),ALLOC(2);
2660= ACT,,ATRIB(17).GT.0,AM07;
2670= ACT,USERF(14),ATRIB(17).GT.0,FR14;
2680= ACT,,ATRIB(17).EQ.0,EV06;
2690=FR14 FREE,BUS/ATRIB(18);
2700=TR04 TERM;
2710=;
2720=EV06 EVENT,6;
2730= ACT,USERF(14);
2740=FR15 FREE,BUS/ATRIB(18);
2750=;
2760= PASSENGER STAGING AREA
2770=;
2780=AW08 AWAIT(11),ALLOC(4);
2790= ACT,USERF(9);
2800=AS13 ASSIGN,ATRIB(11)=USERF(10),ATRIB(17)=USERF(11),ATRIB(18)=0;
2810= ACT,ATRIB(11),ATRIB(11).GT.0,AS13;
2820= ACT,,ATRIB(11).EQ.0.AND.XX(43).EQ.1,AM09;
2830= ACT,,ATRIB(11).EQ.0.AND.XX(43).EQ.0,EV08;
2840=;
2850= LEAVING PAX STAGING- FIRST IF BY FOOT
2860=EV08 EVENT,7;
2870= ACT,XX(44),,AM10;
2880=;
2890= THEN IF BY BUS
2900=AW09 AWAIT(13),ALLOC(2);
2910= ACT,,ATRIB(17).GT.0,AM09;
2920= ACT,XX(44),ATRIB(17).GT.0,FR16;
2930= ACT,,ATRIB(17).EQ.0,EV07;
2940=;
2950=FR16 FREE,BUS/ATRIB(18);
2960=TR05 TERM;
2970=;
2980=EV07 EVENT,7;
2990= ACT,XX(44);
3000=FR17 FREE,BUS/ATRIB(18);
3010=;
3020=;
3030=;

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3000=; PASSENGER TERMINAL
 3010=;
 3020=AW10 AWAIT(14),ALLOC(5);
 3030=AW11 AWAIT(15),PAXAGENT/1;
 3040= ACT,USERF(12);
 3050=FR18 FREE,PAXAGENT/1,1;
 3060= ACT,,DRAND(3).LT.XX(46),AS15;
 3070= ACT,,,AS16;
 3080=;
 3090=; SOME WILL WALK TO THE AIRCRAFT
 3100=AS15 ASSIGN,ATRI(11)=USERF(16);
 3110= ACT,ATRI(11);
 3120=EV10 EVENT,8;
 3130= ACT,XX(49),,CO01;
 3140=;
 3150=; SOME WILL RIDE BUSES
 3160=AS16 ASSIGN,ATRI(11)=USERF(17),ATRI(17)=USERF(11);
 3170= ACT,ATRI(11);
 3180=AW12 AWAIT(17),ALLOC(2);
 3190= ACT,,ATRI(17).GT.0,AW12;
 3200= ACT,XX(47),ATRI(17).GT.0,FR20;
 3210= ACT,,ATRI(17).EQ.0,EV09;
 3220=;
 3230=FR20 FREE,BUS/ATRI(18);
 3240=TR06 TERM;
 3250=;
 3260=EV09 EVENT,8;
 3270= ACT,XX(47);
 3280=FR21 FREE,BUS/ATRI(18);
 3290=;
 3300=;
 3310=; STATISTICS ARE COLLECTED ON THE DIFFERENCE BETWEEN WHEN THE FRM
 3320=; WAS SUPPOSED TO BE AT ITS PLANE AND WHEN IT ACTUALLY MADE IT.
 3330=CO01 COLCT,INTVL(2),PAX DEPART VAR,10/-1.5/.5;
 3340=TR07 TERM;
 3350=;
 3360=;
 3370=; ONBASE DEPLOYING PERSONNEL FEED FROM THE MOBILITY LINE (OUTSIDE
 3380=; THE RECEPTION SYSTEM) INTO PAX STAGING.
 3390=GN03 GOON;
 3400= ACT,XX(51),XX(50).EQ.0,AW08;
 3410=;
 3420=; IF NEED BUS TRANSPORT TO PAX STAGING-
 3430= ACT,,XX(50).EQ.1;
 3440=AS17 ASSIGN,ATRI(17)=USERF(11);
 3450=AW14 AWAIT(20),ALLOC(2);
 3460= ACT,,ATRI(17).GT.0,AW14;
 3470= ACT,XX(51),ATRI(17).GT.0,FR22;
 3480= ACT,XX(51),ATRI(17).EQ.0,FR28;
 3490=;

3500=FR22 FREE,BUS/ATRIB(18);
 3510=TR08 TERM;
 3520=;
 3530=FR28 FREE,BUS/ATRIB(18);
 3540= ACT,,,AW08;
 3550=;
 3560=;
 3570=; CARGO SUBNETWORK
 3580=;
 3590=;
 3600=GN05 GOON;
 3610= ACT,,ATRIB(10).EQ.2,AW15;
 3620= ACT,,ATRIB(10).EQ.4,GN07;
 3630= ACT,,ATRIB(10).EQ.3,AS42;
 3640= ACT,,ATRIB(10).EQ.5,GN08;
 3650=;
 3660=;OFF-BASE URC BRANCH
 3670=AW15 AWAIT(22),CARGAGNT/1;
 3680= ACT,USERF(19);
 3690=FR29 FREE,CARGAGNT/1;
 3700= ACT,XX(56),ATRIB(5).GT.0,AS18;
 3710= ACT,,ATRIB(6).GT.0,AS25;
 3720=;
 3730=;VEHICLE PROCESSING BRANCH
 3740=AS18 ASSIGN,ATRIB(3)=0,ATRIB(17)=USERF(18),ATRIB(18)=0;
 3750=;
 3760=;WASHRACK
 3770=AW16 AWAIT(23),ALLOC(6);
 3780= ACT,,ATRIB(17).GT.0,AW16;
 3790= ACT,XX(55),ATRIB(17).GT.0,FR30;
 3800= ACT,XX(55),ATRIB(17).EQ.0,FR31;
 3810=FR30 FREE,WASHRACK/ATRIB(18);
 3820=TR09 TERM;
 3830=;
 3840=FR31 FREE,WASHRACK/ATRIB(18);
 3850= ACT,XX(57);
 3860=AS19 ASSIGN,ATRIB(17)=USERF(18),ATRIB(18)=0;
 3870=;
 3880=;OTHER VEHICLE PROCESSING
 3890=AW17 AWAIT(24),ALLOC(7);
 3900= ACT,,ATRIB(17).GT.0,AW17;
 3910= ACT,XX(58),ATRIB(17).GT.0,FR32;
 3920= ACT,XX(58),ATRIB(17).EQ.0,FR33;
 3930=FR32 FREE,VEHPROCS/ATRIB(18);
 3940=TR10 TERM;
 3950=;
 3960=FR33 FREE,VEHPROCS/ATRIB(18);
 3970=AS20 ASSIGN,ATRIB(11)=USERF(20),ATRIB(17)=USERF(18),ATRIB(4)=0,
 3980= ATRIB(3)=0;
 3990= ACT,XX(59),ATRIB(11).LE.XX(64),AW19;
 4000= ACT,XX(65),ATRIB(11).GT.XX(64),AW18;

4010=;
 4020=FR41 COLCT
 4030=ACT,XX(17(25),ALLOC(2);
 4040=ACT,USERF(21);
 4050=FREE,WARF/ATRIB(18);
 4060=;
 4070=;
 4080=;
 4090=ACT,XX(17(25),ALLOC(9);
 4100=ACT,XX(17),GT.0,AW19;
 4110=ACT,USERF(22),ATRIB(17),GT.0,FR35;
 4120=ACT,USERF(22),XX(17),GT.0,FR35;
 4130=FR35 FREE,JITEAM/ATRIB(18);
 4140=TR11 TERM;
 4150=;
 4160=FR36 FREE,JITEAM/ATRIB(18);
 4170=ACT,XX(74),ATRIB(4),GT.0,AS21;
 4180=ACT,,ATRIB(3),GT.0,AS22;
 4190=;
 4200=;FRUSTRATED VEHICLES
 4210=AS22 ASSIGN,ATRIB(17)=ATRIB(3),ATRIB(18)=0,1;
 4220=ACT,XX(59),DRAND(3),LT.XX(62),AW17;
 4230=ACT,XX(63),,AW21;
 4240=;
 4250=;XX(62) % RETURN TO OTHER PROCESSING
 4260=;OTHERS NEED REMASHING
 4270=AW21 AWAIT(28),ALLOC(6);
 4280=ACT,,ATRIB(17),GT.0,AW21;
 4290=ACT,XX(55),ATRIB(17),GT.0,FR37;
 4300=ACT,XX(55),ATRIB(17),EQ.0,FR38;
 4310=FR37 FREE,WASHRACK/ATRIB(18);
 4320=TR12 TERM;
 4330=;
 4340=FR38 FREE,WASHRACK/ATRIB(18);
 4350=AS23 ASSIGN,ATRIB(17)=ATRIB(3),ATRIB(3)=0,ATRIB(18)=0,ATRIB(4)=0;
 4360=ACT,XX(63),,AW19;
 4370=;
 4380=;VEHICLES WHICH PASSED J1
 4390=AS21 ASSIGN,ATRIB(17)=USERF(23),ATRIB(18)=0;
 4400=AW20 AWAIT(27),ALLOC(14);
 4410=ACT,USERF(24);
 4420=FR39 FREE,MARSAREA/ATRIB(18);
 4430=CO02 COLCT,INTVL(2),URC DEPART VAR,10/-1.5/.5;
 4440=TR13 TERM;
 4450=;
 4460=;NON-VEHICULAR CARGO BRANCH
 4470=AS25 ASSIGN,ATRIB(17)=USERF(25),ATRIB(3)=0,ATRIB(18)=0,ATRIB(4)=0;


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4480=;UNIT ASSEMBLY AREA(S)
4490=AM22  AWAIT(29),ALLOC(10);
4500=    ACT,,ATRIB(17).GT.0,AS40;
4510=    ACT,,ATRIB(12).GT.0,AS26;
4520=    ACT,,ATRIB(13).GT.0,AS27;
4530=    ACT,,ATRIB(14).GT.0,AS28;
4540=    ACT,,ATRIB(15).GT.0,AS29;
4550=    ACT,,ATRIB(16).GT.0,AS30;
4560=;
4570=;IF MORE NEED MARSAREA, LOOP BACK
4580=AS40  ASSIGN,ATRIB(12)=0,ATRIB(13)=0,ATRIB(14)=0,ATRIB(15)=0,
4590=      ATRIB(16)=0;
4600=    ACT,,AM22;
4610=;
4620=;INTO UASAREA1
4630=AS26  ASSIGN,ATRIB(13)=0,ATRIB(14)=0,ATRIB(15)=0,ATRIB(16)=0,
4640=      ATRIB(17)=ATRIB(12);
4650=    ACT,,GN06;
4660=;
4670=;INTO UASAREA2
4680=AS27  ASSIGN,ATRIB(12)=0,ATRIB(14)=0,ATRIB(15)=0,ATRIB(16)=0,
4690=      ATRIB(17)=ATRIB(13);
4700=    ACT,,GN06;
4710=;
4720=;INTO UASAREA3
4730=AS28  ASSIGN,ATRIB(12)=0,ATRIB(13)=0,ATRIB(15)=0,ATRIB(16)=0,
4740=      ATRIB(17)=ATRIB(14);
4750=    ACT,,GN06;
4760=;
4770=;INTO UASAREA4
4780=AS29  ASSIGN,ATRIB(12)=0,ATRIB(13)=0,ATRIB(14)=0,ATRIB(16)=0,
4790=      ATRIB(17)=ATRIB(15);
4800=    ACT,,GN06;
4810=;
4820=;INTO UASAREA5
4830=AS30  ASSIGN,ATRIB(12)=0,ATRIB(13)=0,ATRIB(14)=0,ATRIB(15)=0,
4840=      ATRIB(17)=ATRIB(16);
4850=    ACT,,GN06;
4860=;
4870=GN06  GOON;
4880=    ACT,USERF(26);
4890=AS31  ASSIGN,ATRIB(11)=USERF(21);
4900=    ACT,ATRIB(11);
4910=;
4920=;AWAIT PALLET TRANSPORT
4930=AM23  AWAIT(30),ALLOC(11);
4940=    ACT,,ATRIB(17).GT.0,AM23;
4950=    ACT,USERF(32),,FR40;
4960=FR40  FREE,UASFORK/1;
4970=EV11  EVENT,9;
4980=    ACT,USERF(27);

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4990=AS32  ASSIGN, ATRIB(17)=ATIB(18);
5000=AW24  AWAIT(35), JIFORK/1;
5010=      ACT, USERF(32);
5020=FR41  FREE, JIFORK/1;
5030=FR42  FREE, FLATBED/1;
5040=;
5050=;AWAIT JOINT INSPECTION
5060=AW25  AWAIT(31), ALLOC(9);
5070=      ACT,, ATRIB(17).GT.0, AW25;
5080=      ACT, USERF(28), ATRIB(17).GT.0, FR51;
5090=      ACT, USERF(28), ATRIB(17).EQ.0, FR43;
5100=;
5110=FR51  FREE, JITEAM/ATIB(18);
5120=TR17  TERM;
5130=;
5140=;
5150=;AFTER INSPECTION COMPLETED
5160=FR43  FREE, JITEAM/ATIB(18);
5170=;
5180=;SORT THE PASSES FROM THE FAILS
5190=      ACT,, ATRIB(4).GT.0, AS38;
5200=      ACT,, ATRIB(3).GT.0, AS35;
5210=;
5220=;FRUSTRATED PALLET BRANCH
5230=AS35  ASSIGN, ATRIB(17)=ATIB(3), ATRIB(4)=0, ATRIB(18)=0;
5240=AW26  AWAIT(32), ALLOC(13);
5250=      ACT,, ATRIB(17).GT.0, AW26;
5260=      ACT, IX(72), ATRIB(17).GT.0, FR44;
5270=      ACT, IX(72), ATRIB(17).EQ.0, FR45;
5280=FR44  FREE, JIFORK/ATIB(18);
5290=TR14  TERM;
5300=;
5310=FR45  FREE, JIFORK/ATIB(18);
5320=AS36  ASSIGN, ATRIB(17)=ATIB(3), ATRIB(18)=0;
5330=AW27  AWAIT(36), ALLOC(12);
5340=      ACT, USERF(30);
5350=FR46  FREE, FRUSTCAR/ATIB(18);
5360=AW28  AWAIT(34), ALLOC(13);
5370=      ACT,, ATRIB(17).GT.0, AW28;
5380=      ACT, IX(72), ATRIB(17).GT.0, FR47;
5390=      ACT, IX(72), ATRIB(17).EQ.0, FR48;
5400=FR47  FREE, JIFORK/ATIB(18);
5410=TR15  TERM;
5420=;
5430=FR48  FREE, JIFORK/ATIB(18);
5440=AS37  ASSIGN, ATRIB(17)=ATIB(3), ATRIB(18)=0, ATRIB(3)=0;
5450=      ACT,, , AW25;
5460=;

```

5470=;NON-FAILED PALLETS
 5480=AS38 ASSIGN, ATRIB(17)=ATRI(4), ATRIB(18)=0, ATRIB(3)=0,
 5490= ATRIB(11)=USERF(24);
 5500=AW29 AWAIT(33), ALLOC(13);
 5510= ACT,, ATRIB(17).GT.0, AW29;
 5520= ACT, XX(73), ATRIB(17).GT.0, FR49;
 5530= ACT, XX(73), ATRIB(17).EQ.0, FR50;
 5540=FR49 FREE, JIFORK/ATRI(18);
 5550=TR16 TERM;
 5560=;
 5570=FR50 FREE, JIFORK/ATRI(18);
 5580=AS39 ASSIGN, ATRIB(17)=USERF(29), ATRIB(18)=0;
 5590= ACT,, AW20;
 5600=;
 5610=;ON-BASE URC BRANCH
 5620=GN07 GOON;
 5630= ACT,, ATRIB(5).GT.0, AS18;
 5640= ACT,, ATRIB(6).GT.0, AS41;
 5650=AS41 ASSIGN, ATRIB(17)=USERF(25), ATRIB(3)=0, ATRIB(4)=0;
 5660= ACT, USERF(33), AS31;
 5670=;
 5680=; OFFBASE NRC BRANCH
 5690=;
 5700=AS42 ASSIGN, ATRIB(17)=USERF(37);
 5710=AW30 AWAIT(6), NRCREPT/ATRI(17);
 5720=AW31 AWAIT(9), NRCAGENT/1;
 5730= ACT, USERF(34);
 5740=FR52 FREE, NRCAGENT/1;
 5750=AS43 ASSIGN, ATRIB(11)=USERF(35);
 5760=FR53 FREE, NRCREPT/ATRI(17);
 5770= ACT, XX(75);
 5780=AW32 AWAIT(16), ALLOC(15);
 5790=AW33 AWAIT(18), ALLOC(16);
 5800= ACT,, ATRIB(4).GT.0, AW33;
 5810= ACT, XX(77), ATRIB(4).GT.0, FR54;
 5820= ACT, XX(77), ATRIB(4).EQ.0, FR55;
 5830=FR54 FREE, TERMFOR/1;
 5840=TR18 TERM;
 5850=;
 5860=FR55 FREE, TERMFOR/1;
 5870=AS44 ASSIGN, ATRIB(11)=USERF(36);
 5880= ACT, ATRIB(11);
 5890=FR56 FREE, NRCTERM/ATRI(18);
 5900=CD03 COLCT, INTVL(2), NRC DEPART VAR, 10/-1.5/.5;
 5910=TR19 TERM;
 5920=;

5930=; ON BASE NRC
5940=;
5950=GN08 600N;
5960= ACT,,XX(76).EQ.1,AS42;
5970= ACT,,XX(76).EQ.0,AS45;
5980=AS45 ASSIGN,ATRIB(17)=USERF(37);
5990= ACT,,,AW32;
6000= END NETWORK

6010=INIT,0,2160;
6020=FIN;
6030=4EOR

PHASE II SUBROUTINES

```

100=  PROGRAM MAIN (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7)
110=C  TESTSUB UPDATE 30 AUG 2015 HOURS
120=C*****
130=C
140=C  MAIN PROGRAM IS USED TO INCREASE DIMENSION OF
150=C  NSET/ QSET TO 30000
160=C
170=C
180=  DIMENSION NSET(30000)
190=  COMMON/SCOM1/ ATRIB(100),DB(100),DDL(100),DTNOW,II,MFA,MSTOP,NCLNR
200=  +,NCRDR,NPRNT,NNRUN,NMSET,NTAPE,SS(100),SSL(100),TNEXT,TNOW,XX(100)
210=  COMMON QSET(30000)
220=  EQUIVALENCE (NSET(1),QSET(1))
230=  NMSET=30000
240=  NCRDR=5
250=  NPRNT=6
260=  NTAPE=7
270=  CALL SLAM
280=  STOP
290=  END
300=C
310=C*****
320=C
330=C  SUBROUTINE EVENT PROCESSES THE TPFDD DATA TO
340=C  A FORM ACCEPTABLE TO THE SIMULATION
350=C
360=  SUBROUTINE EVENT(I)
370=  DIMENSION NSET(30000)
380=  COMMON /SCOM1/ ATRIB(100),DB(100),DDL(100),DTNOW,II,MFA,
390=  +MSTOP,NCLNR,NCRDR,NPRNT,NNRUN,NMSET,NTAPE,
400=  +SS(100),SSL(100),TNEXT,TNOW,XX(100)
410=  COMMON QSET(30000)
420=  EQUIVALENCE (NSET(1),QSET(1))
430=  INTEGER NPAX,EDD,ALD,TYPE,N
440=  REAL TOTSTON,VEHSTON,NVESTON,BULSTON,OVRSTON,OUTSTON,A(18)
450=  CHARACTER FRN$5,ORIGIN$4,POE$4,DEST$4
460=C
470=C
480=  GO TO (1,2,3,4,5,6,7,8,9,10),I

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490=C:*****
500=1    CONTINUE
510=C    **THIS EVENT TAKES THE INPUT FROM A FILE AND AFTER THE
520=C      NEEDED MANIPULATIONS ARE DONE INSERTS THE ENTITIES INTO
530=C      SLAM FILE #1 FOR SORTING. FILE #1 IS THEN EMPTIED ONTO
540=C      DISC STORAGE AS FILE 'TAPE80' AND READ IN PERIODICALLY BY
550=C      EVENT(2). THIS ROUTINE MUST BE MODIFIED IN FUTURE USE TO SUIT
560=C      THE INPUT DATA FORMAT.
570=C
580=C    **THE PROCESS WILL CONTINUE UNTIL ALL RECORDS HAVE BEEN READ.
590=C
600=C
610=C    N IS INITIALIZED HERE, IS USED AS A COUNTER IN EVENT(2)
620=C    N = 0
630=C
640=100  READ(70,50,END=200) FRM,NPAX,BULSTON,OVRSTON,OUTSTON,NAIRST,
650=C    +   ORIGIN,POE,ALD,EDD,DEST,TYPE
660=C    IF (XX(99).EQ.1) PRINT 50,FRM,NPAX,BULSTON,OVRSTON,OUTSTON,NAIRST,
670=C    +   ORIGIN,POE,ALD,EDD,DEST,TYPE
680=50   FORMAT(1X,A5,1X,I5,4(1X,F7.0),2(1X,A4),2(1X,I3),1X,A4,1X,I1)
690=C
700=C
710=C    **ATRID(2) IS THE EXPECTED DEPARTURE TIME, XX(3) = FLIGHT TIME
720=C    XX(4) = (EDD * 24.0) - XX(3) - 24.0
730=C    XX(5) = (EDD * 24.0) - XX(3)
740=C    A(2) = UNFRM(XX(4),XX(5),1)
750=C
760=C    **ATRID(3) IS THE NUMBER OF PASSENGERS
770=C    A(3) = NPAX
780=C
790=C    **ATRID(4) IS THE TOTAL STONS OF CARGO
800=C    A(4) = .10 * (BULSTON + OVRSTON + OUTSTON)
810=C
820=C    **ATRID(7) IS THE BULK STON AMOUNT
830=C    A(7) = BULSTON * .10
840=C
850=C    **ATRID(8) IS THE OVERSIZE STON AMOUNT
860=C    A(8) = OVRSTON * .10
870=C
880=C    **ATRID(9) IS THE OUTSIZE STON AMOUNT
890=C    A(9) = OUTSTON * .10
900=C
910=C    **ATRID(10) IS THE TYPE OF UNIT
920=C    IF (DEST.EQ.'ZHTV') A(10) = 1
930=C    IF (TYPE.EQ.2.AND.DEST.NE.'ZHTV'.AND.ORIGIN.NE.'ZHTV') A(10)=2
940=C    IF (TYPE.EQ.3.AND.DEST.NE.'ZHTV'.AND.ORIGIN.NE.'ZHTV') A(10)=3
950=C    IF (TYPE.EQ.2.AND.DEST.NE.'ZHTV'.AND.ORIGIN.EQ.'ZHTV') A(10)=4
960=C    IF (TYPE.EQ.3.AND.DEST.NE.'ZHTV'.AND.ORIGIN.EQ.'ZHTV') A(10)=5
970=C

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980=C      **TRIB(5) IS THE VEHICULAR STON ESTIMATE
990=C      THE USER DETERMINES BY XX(52) WHICH ESTIMATION METHOD TO USE.
1000=      IF (XX(52).EQ.0) THEN
1010=          IF (A(10).EQ.2.OR.A(10).EQ.4) A(5) = .8 * A(4)
1020=          IF (A(10).EQ.3.OR.A(10).EQ.5) A(5) = .1 * A(4)
1030=          IF (A(10).EQ.1) A(5) = 0.0
1040=      ELSE IF (XX(52).EQ.1) THEN
1050=          A(5) = A(8) + A(9)
1060=      ELSE
1070=          PRINT*, 'ERROR: XX(52) MUST BE 0 OR 1'
1080=      END IF
1090=C
1100=C      **TRIB(6) IS THE NON-VEHICULAR STON ESTIMATE
1110=      A(6) = A(4) - A(5)
1120=C
1130=C      **TRIB(1) IS THE ARRIVAL TIME AT THE APOE, AND IS BASED
1140=C      ON THE TYPE OF UNIT AND OTHER AVAILABLE PARAMETERS.
1150=      IF (A(10).EQ.1) THEN
1160=          A(1) = A(2) + XX(3)
1170=      ELSE IF (A(10).EQ.2.OR.A(10).EQ.3) THEN
1180=          XX(1) = ((ALD*24)-24)
1190=          XX(2) = (ALD*24)
1200=          A(1) = UNFRM(XX(1),XX(2),2)
1210=          IF (A(1).GT.A(2)) A(1) = A(2)-12
1220=          IF (A(1).LT.0.0) A(1) = 0.0
1230=      ELSE
1240=          A(1) = A(2)-XX(7)
1250=          IF (A(1).LT.0) A(1) = 0.0
1260=      END IF
1270=C      **TRIBS (11) THROUGH (18) ARE SET TO ZERO, DEFINED LATER
1280=      A(11) = 0
1290=      A(12) = 0
1300=      A(13) = 0
1310=      A(14) = 0
1320=      A(15) = 0
1330=      A(16) = 0
1340=      A(17) = 0
1350=      A(18) = 0
1360=C
1370=C
1380=C      **THE NEXT FEW LINES SCREEN FOR PROBLEMS
1390=      IF (MAIRST.GT.0) PRINT*, 'NON-AIRLIFT CARGO IN FRN # ',FRN
1400=C
1410=C      **THE TRACE, IF ACTIVATED BY XX(99) =2, WILL PRINT THE ARRAY
1420=      IF (XX(99).EQ.1) PRINT 170,FRN,A(1),A(2),A(3),A(4),A(5),A(6),
1430=      +      A(7),A(8),A(9),A(10),A(11)
1440=170    FORMAT(1X,A5,9(1X,F6.2),1X,F2.0,1X,F2.1)
1450=C
1460=C

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1470=C  **WITH ALL ATRIBUTES DEFINED, THE ENTIT IS FILED AWAY
1480=    CALL FILEM(1,A)
1490=C
1500=C  **RETURN TO DO THE NEXT ENTITY
1510=    GO TO 100
1520=C
1530=C  **END OF FILE TRIGGERS 200
1540=200 CALL RMOVE(1,1,A)
1550=    DO 77 I=1,18
1560=        WRITE (80,4) A(I)
1570=77  CONTINUE
1580=    IF (NNQ(1).GE.1) GO TO 200
1590=    REWIND 80
1600=    RETURN
1610=C
1620=C
1630=C
1640=C*****
1650=C  **EVENT 2 PULLS THE ENTITIES OUT OF FILE 1 AS THEIR ARRIVAL TIMES
1660=C  APPROACH. FILE 1 IS RANKED LVF ON ATRIB(1), THE ARRIVAL TIME
1670=C  AND IS REPLENISHED WITH FRNS PULLED FROM THE INCOMING
1680=C  FRN LIST PREVIOUSLY WRITTEN TO TAPE80 BY EVENT(1). THE
1690=C  IDEA IS TO KEEP AT LEAST FIVE BUT NO MORE THAN 50 FRNS
1700=C  IN FILE 1 AT ALL TIMES, UNTIL THERE ARE NO MORE COMING.
1710=C
1720=2  IF (NNQ(1).LE.5.AND.XX(95).EQ.0) THEN
1730=    DO 78 K=1,50
1740=        DO 79 I=1,18
1750=            XX(95) = 1
1760=            READ (80,8,END=210) A(I)
1770=            XX(95) = 0
1780=79  CONTINUE
1790=    CALL FILEM(1,A)
1800=    N = N + 1
1810=78  CONTINUE
1820=210 IF (XX(95).EQ.1) THEN
1830=    PRINT*,N,' FRNS LOADED INTO FILE 1'
1840=    END IF
1850=    END IF
1860=    IF (NNQ(1).EQ.0) RETURN
1870=    CALL RMOVE(1,1,ATRIB)
1880=C
1890=C  **THE TIME REMAINING TO ARRIVAL IS COMPUTED AND PLACED INTO
1900=C  ATRIB(1), AND USED AS THE DURATION OF THE LEADIN ACTIVITY
1910=    ATRIB(1) = ATRIB(1) - TNOW
1920=    RETURN
1930=C

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1940=C*****
1950=C    **THE NEW FIRST ENTITY'S ATRIBUTES ARE COPIED INTO ATRIB
1960=C    SO WE CAN DETERMINE HOW LONG BEFORE IT WILL ARRIVE
1970=3    IF(NNQ(1).EQ.0) RETURN
1980=     CALL COPY(1,1,ATRIB)
1990=     ATRIB(1) = ATRIB(1) - TNGW
2000=     RETURN
2010=C*****
2020=C    EVENT(4) FREES THE RECEPTION POINT
2030=4    II=MAX(ATRIB(12),ATRIB(13),ATRIB(14),ATRIB(15),ATRIB(16))
2040=     CALL FREE(2,II)
2050=     RETURN
2060=C
2070=C*****
2080=C    EVENT(5) FREES THE APPROPRIATE BILLET AREA FEEDING RESOURCE, AND
2090=C    CALCULATES THE NUMBER OF BUSES THIS GROUP NEEDS (ATRIB(17)).
2100=5    II=ATRIB(18)
2110=     IF(ATRIB(12).GT.0) CALL FREE(7,II)
2120=     IF(ATRIB(13).GT.0) CALL FREE(8,II)
2130=     IF(ATRIB(14).GT.0) CALL FREE(9,II)
2140=     IF(ATRIB(15).GT.0) CALL FREE(10,II)
2150=     IF(ATRIB(16).GT.0) CALL FREE(11,II)
2160=     ATRIB(17) = USERF(11)
2170=     ATRIB(18) = 0
2180=     RETURN
2190=C
2200=C*****
2210=C    EVENT(6) FREES THE BILLETING AREAS, USING THE SAME LOOPING TRICK
2220=C    EMPLOYED TO ALLOCATE IT IN ALLOC(1)
2230=6    II=MAX(ATRIB(12),ATRIB(13),ATRIB(14),ATRIB(15),ATRIB(16))
2240=     DO 15 J=12,16
2250=         IF(ATRIB(J).GT.0) CALL FREE(J,II)
2260=15    CONTINUE
2270=     RETURN
2280=C
2290=C*****
2300=C    EVENT(7) FREES PAX STAGING AND PAX STAGING FEEDING RESOURCES.
2310=7    II=ATRIB(5)
2320=     CALL FREE(6,II)
2330=     II=ATRIB(4)
2340=     CALL FREE(5,II)
2350=     ATRIB(4) = 0
2360=     ATRIB(5) = 0
2370=     RETURN
2380=C
2390=C*****
2400=C    EVENT(8) FREES THE TERMINAL
2410=8    II=ATRIB(4)
2420=     CALL FREE(17,II)
2430=     ATRIB(4) = 0
2440=     RETURN
2450=C

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2460=C*****
2470=C
2480=C      EVENT(9) FREES THE UNIT ASSEMBLY AREA FROM WHICH THE FRN IS COMING
2490=C      ATRIB(18) IS THE # OF PALLETS ON THIS LOAD
2500=C
2510=C      II=MAX(ATRIB(12),ATRIB(13),ATRIB(14),ATRIB(15),ATRIB(16))
2520=C      NBR = ATRIB(18)
2530=C      IF (II.EQ.0) RETURN
2540=C      IF (II.EQ.ATRIB(12)) CALL FREE(25,NBR)
2550=C      IF (II.EQ.ATRIB(13)) CALL FREE(26,NBR)
2560=C      IF (II.EQ.ATRIB(14)) CALL FREE(27,NBR)
2570=C      IF (II.EQ.ATRIB(15)) CALL FREE(28,NBR)
2580=C      IF (II.EQ.ATRIB(16)) CALL FREE(29,NBR)
2590=C      RETURN
2600=C
2610=C*****
2620=C
2630=C      EVENT(10) IS USED TO GENERATE A SET OF HYPOTHETICAL DATA USED
2640=C      TO DEMONSTRATE THE MODEL.
2650=C
2660=10      DO 88 I=1,1000
2670=C      FRN = 'ABCDE'
2680=C      XX(97) = DRAND(4)
2690=C      IF (XX(97).LT..25) THEN
2700=C          TYPE = 3
2710=C          NPAX = 0
2720=C      ELSE
2730=C          TYPE = 2
2740=C          NPAX = TRIAG(10.0,100.0,300.0,4)
2750=C      END IF
2760=C      EDD = TRIAG(2.0,25.0,90.0,5)
2770=C      ALD = EDD - 1
2780=C      BULSTON = TRIAG(0.0,50.0,500.0,6)
2790=C      OVRSTON = TRIAG(0.0,75.0,300.0,6)
2800=C      OUTSTON = TRIAG(0.0,25.0,250.0,6)
2810=C      NAIRST = 0
2820=C      IF(XX(97).LT..20) THEN
2830=C          ORIGIN = 'ZHTV'
2840=C          DEST = 'XXXX'
2850=C          POE = 'XXXX'
2860=C      ELSE IF (XX(97).LT..90) THEN
2870=C          ORIGIN = 'XXXX'
2880=C          DEST = 'XXXX'
2890=C          POE = 'ZHTV'
2900=C      ELSE
2910=C          ORIGIN = 'XXXX'
2920=C          DEST = 'ZHTV'
2930=C          POE = 'XXXX'
2940=C      END IF

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2950= WRITE(70,50) FRN,NPAX,BULSTON,OVRSTON,OUTSTON,NAIRST,
2960= + ORIGIN,POE,ALD,EDD,DEST,TYPE
2970=88 CONTINUE
2980= REWIND 70
2990= RETURN
3000=C
3010=C
3020= END
3030=C
3040=C
3050=C*****
3060=C SUBROUTINE INTLC INITIALIZES THE XX(.) ARRAY
3070=C TO 0.0, THEN SETS CERTAIN VARIABLES TO USER-
3080=C DEFINED VALUES
3090=C
3100=C
3110= SUBROUTINE INTLC
3120= DIMENSION NSET(30000)
3130= COMMON /SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,
3140= +MSTOP,NCLNR,NCRDR,NPRNT,NMRUN,NMSET,NTAPE,
3150= +SS(100),SSL(100),TNEXT,TNOW,XX(100)
3160= COMMON QSET(30000)
3170= EQUIVALENCE (NSET(1),QSET(1))
3180=C
3190=C **THE ENTIRE XX(.) ARRAY IS FIRST SET TO 0.0**
3200=C
3210= DO 10 I=1,100
3220= XX(I) = 0.0
3230=10 CONTINUE
3240=C
3250=C **THEN CERTAIN VARIABLES ARE SET TO USER- DEFINED VALUES**
3260=C
3270=C ** XX(3) = FLIGHT TIME TO THE COMBAT THEATER
3280=C XX(3) = 8.5
3290=C
3300=C ** XX(6) = THE EARLIEST TIME PRIOR TO DEPARTURE THAT
3310=C BILLETED FRNS MAY REPORT TO PAX STAGING
3320=C XX(6) = 10.0
3330=C
3340=C ** XX(7) = HOURS BEFORE DEPARTURE THAT ONBASE PAX WILL GO TO THE
3350=C PAX STAGING AREA, ONBASE VEHICULAR URC WILL GO TO THE
3360=C VEHICLE PROCESSING AREA, AND ONBASE NRC WILL GO TO THE CARGO
3370=C TERMINAL. NOTE THAT USERF(33) IMPOSES ADDITIONAL DELAY ON
3380=C THE MOVEMENT OF ONBASE NONVEHICULAR URC TO TO MARSHALLING
3390=C AREA.
3400= XX(7) = 12.0
3410=C
3420=C ** XX(8) IS THE MINIMUM TIME BEFORE DEPARTURE TO
3430=C JUSTIFY ALLOCATION OF BILLETING
3440= XX(8) = 18.0
3450=C

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3460=C ** XX(9) IS THE TIME BEFORE DEPARTURE CARGO SHOULD
 3470=C ENTER THE MARSHALLING AREA
 3480= XX(9) = 3.5
 3490=C
 3500=C ** XX(11) - (20) NOT USED IN PHASE II
 3510=C
 3520=C **SEVERAL VARIABLES ARE USED TO INDICATE "TYPE TRANSPORT"
 3530=C FROM ONE AREA TO ANOTHER. IN EVERY SUCH CASE, A "0" INDICATES
 3540=C WALKING, AND A "1" INDICATES THAT A BUS MUST BE PROVIDED.
 3550=C SHOULD ANY OTHER VALUE BE USED, ALL BETS ARE OFF.
 3560=C
 3570=C ** XX(21) = TYPE TRANSPORT RECPPOINT TO TRABIL1
 3580= XX(21) = 0
 3590=C ** XX(22) = TYPE TRANSPORT RECPPOINT TO TRABIL2
 3600= XX(22) = 1
 3610=C ** XX(23) = TYPE TRANSPORT RECPPOINT TO TRABIL3
 3620= XX(23) = 1
 3630=C ** XX(24) = TYPE TRANSPORT RECPPOINT TO TRABIL4
 3640= XX(24) = 1
 3650=C ** XX(25) = TYPE TRANSPORT RECPPOINT TO TRABIL5
 3660= XX(25) = 1
 3670=C
 3680=C ** "TRANSIT DURATION" REFERS TO THE TIME NEEDED TO MOVE
 3690=C TO THE NEXT AREA, AND IS RELATED TO THE "TYPE TRANSPORT"
 3700=C NAMED FOR THAT MOVE. IF THE TYPE WAS FOOT, THE DURATION
 3710=C IS THE ONE-WAY WALKING TIME. IF THE TYPE WAS BUS, THE
 3720=C DURATION IS THE ROUND TRIP TIME, ON THE ASSUMPTION THAT
 3730=C IT IS UNLIKELY THAT A LOAD WILL BE WAITING FOR THE BUS
 3740=C AT THE DESTINATION OF THIS TRIP. BY USING THE ROUND TRIP
 3750=C TIME, THE BUS IS NOT IMMEDIATELY AVAILABLE WHEN IT UNLOADS
 3760=C AT THE DESTINATION. THE EXTRA TIME BEFORE IT BECOMES
 3770=C AVAILABLE REFLECTS THE TIME IT WOULD SPEND DRIVING
 3780=C TO ITS NEXT PICKUP POINT.
 3790=C
 3800=C RECALL THAT ALL TIMES ARE EXPRESSED AS HOURS.
 3810=C
 3820=C ** XX(26) = DURATION RECPPOINT TO TRABIL1
 3830= XX(26) = .5
 3840=C ** XX(27) = DURATION RECPPOINT TO TRABIL2
 3850= XX(27) = .4
 3860=C ** XX(28) = DURATION RECPPOINT TO TRABIL3
 3870= XX(28) = .75
 3880=C ** XX(29) = DURATION RECPPOINT TO TRABIL4
 3890= XX(29) = 1.0
 3900=C ** XX(30) = DURATION RECPPOINT TO TRABIL5
 3910= XX(30) = 1.0
 3920=C

3930=C ** THE NEXT GROUP REFLECTS TYPE AND DURATION FOR THE
 3940=C MOVE FROM TRANSIENT BILLETING TO PAX STAGING
 3950=C
 3960=C ** XX(31) = TYPE TRANSPORT TRABIL1 TO PAX STAGING
 3970= XX(31) = 0
 3980=C ** XX(32) = TYPE TRANSPORT TRABIL2 TO PAX STAGING
 3990= XX(32) = 1
 4000=C ** XX(33) = TYPE TRANSPORT TRABIL3 TO PAX STAGING
 4010= XX(33) = 1
 4020=C ** XX(34) = TYPE TRANSPORT TRABIL4 TO PAX STAGING
 4030= XX(34) = 1
 4040=C ** XX(35) = TYPE TRANSPORT TRABIL5 TO PAX STAGING
 4050= XX(35) = 1
 4060=C
 4070=C ** XX(36) = DURATION TRABIL1 TO PAX STAGING
 4080= XX(36) = .5
 4090=C ** XX(37) = DURATION TRABIL2 TO PAX STAGING
 4100= XX(37) = .6
 4110=C ** XX(38) = DURATION TRABIL3 TO PAX STAGING
 4120= XX(38) = .75
 4130=C ** XX(39) = DURATION TRABIL4 TO PAX STAGING
 4140= XX(39) = 1.0
 4150=C ** XX(40) = DURATION TRABIL5 TO PAX STAGING
 4160= XX(40) = 1.0
 4170=C
 4180=C
 4190=C ** XX(41) = TYPE TRANSPORT RECPPOINT TO PAX STAGING
 4200= XX(41) = 1
 4210=C
 4220=C ** XX(42) = DURATION RECPPOINT TO PAX STAGING
 4230= XX(42) = .33
 4240=C
 4250=C ** XX(43) = TYPE TRANSPORT PAX STAGING TO TERMINAL
 4260= XX(43) = 0
 4270=C
 4280=C ** XX(44) = DURATION PAX STAGING TO TERMINAL
 4290= XX(44) = .33
 4300=C
 4310=C ** XX(45) = EARLIEST TIME BEFORE DEPARTURE FRNS WILL
 4320=C MOVE TO TERMINAL
 4330= XX(45) = 4.5
 4340=C
 4350=C ** XX(46) = % OF AIRCRAFT PARKING SPOTS WITHIN WALKING
 4360=C DISTANCE OF THE TERMINAL
 4370= XX(46) = .75
 4380=C
 4390=C ** XX(47) = ROUND TRIP TRANSPORT TIME TO AIRCRAFT VIA BUS
 4400= XX(47) = .5
 4410=C
 4420=C ** XX(48) IS NOT USED
 4430=C

4440=C ** XX(49) = DURATION TERMINAL TO AIRCRAFT VIA FOOT
 4450= XX(49) = .33
 4460=C
 4470=C ** XX(50) = TYPE TRANSPORT MOBILITY LINE TO PAX STAGING
 4480=C (FOR ONBASE DEPLOYING PERSONNEL)
 4490= XX(50) = 1
 4500=C
 4510=C ** XX(51) = DURATION MOBILITY LINE TO PAX STAGING
 4520= XX(51) = .5
 4530=C
 4540=C XX(52) IS A SWITCH. IF SET TO 0, THE MAC % ARE USED IN ESTIMATING
 4550=C THE VEHICULAR CARGO (80% OF URC, 10% OF NRC). IF SET TO 1, THE
 4560=C TOTAL OF OVERSIZE AND OUTSIZE CARGO IS CONSIDERED TO BE VEHICULAR.
 4570= XX(52) = 0
 4580=C
 4590=C ** XX(53) = BEST 'WAG' AVAILABLE FOR AVERAGE VEHICLE WEIGHT
 4600=C (IN SHORT TONS)
 4610= XX(53) = 2.0
 4620=C
 4630=C ** XX(54) = BEST 'WAG' AVAILABLE FOR AVERAGE PALLET WEIGHT
 4640=C (IN SHORT TONS)
 4650= XX(54) = 1.75
 4660=C
 4670=C ** XX(55) = AVERAGE VEHICLE WASH TIME
 4680= XX(55) = .33
 4690=C
 4700=C ** XX(56) = VEHICLE TRANSIT TIME FROM THE RECEPTION POINT
 4710=C TO THE WASHRACK
 4720= XX(56) = .15
 4730=C
 4740=C ** XX(57) = VEHICLE TRANSIT TIME FROM WASHRACK TO VEHICLE
 4750=C PROCESSING AREA
 4760= XX(57) = .20
 4770=C
 4780=C ** XX(58) = VEHICLE PROCESSING TIME (EXCLUDING WASHING)
 4790= XX(58) = .5
 4800=C
 4810=C ** XX(59) = TRANSIT TIME VEHPROC TO JOINT INSPECTION
 4820= XX(59) = .20
 4830=C
 4840=C * XX(60) = PROBABILITY OF FAILING JOINT INSPECTION
 4850= XX(60) = .10
 4860=C
 4870=C ** XX(61) IS NOT USED
 4880=C
 4890=C
 4900=C ** XX(62) = % OF FAILURES DUE TO PROCESSING PROBLEMS
 4910=C OTHER THAN INCORRECT WASHING
 4920= XX(62) = .80
 4930=C

4740=C ** XX(63) = TRANSIT TIME FROM J1 TO WASHRACK
 4750= XX(63) = .20
 4960=C
 4970=C ** XX(64) = EARLIEST TIME (HOURS BEFORE DEPARTURE) TO REPORT
 4980=C TO JOINT INSPECTION
 4990= XX(64) = 5.0
 5000=C
 5010=C ** XX(65) = TRANSIT TIME FROM VEHPROC TO VEHFARK
 5020= XX(65) = .25
 5030=C
 5040=C ** XX(66) = TRANSIT TIME VEHFARK TO J1
 5050= XX(66) = .25
 5060=C
 5070=C ** XX(67) = TRANSIT TIME UASAREA1 TO J1
 5080= XX(67) = .25
 5090=C
 5100=C ** XX(68) = TRANSIT TIME UASAREA2 TO J1
 5110= XX(68) = .30
 5120=C
 5130=C ** XX(69) = TRANSIT TIME UASAREA3 TO J1
 5140= XX(69) = .35
 5150=C
 5160=C ** XX(70) = TRANSIT TIME UASAREA4 TO J1
 5170= XX(70) = .40
 5180=C
 5190=C ** XX(71) = TRANSIT TIME UASAREA5 TO J1
 5200= XX(71) = .50
 5210=C
 5220=C ** XX(72) = TRANSIT TIME J1 TO FRUSTRATED PALLET PROCESSING
 5230= XX(72) = .10
 5240=C
 5250=C ** XX(73) = TRANSIT TIME (PALLETS) J1 TO MARSHALLING AREA
 5260= XX(73) = .1
 5270=C
 5280=C ** XX(74) = TRANSIT TIME (VEHICLES) J1 TO MARSHALLING AREA
 5290= XX(74) = .1
 5300=C
 5310=C ** XX(75) = TRANSIT TIME NRC RECEPTION PT TO NRC TERMINAL
 5320= XX(75) = .25
 5330=C
 5340=C ** XX(76) IS A SWITCH- 1= ONBASE NRC IS PROCESSED BY SURFACE
 5350=C FREIGHT SECTION, 0= NOT
 5360= XX(76) = 1
 5370=C
 5380=C ** XX(77) = TIME FOR TERMFORK TO UNLOAD 1 PALLET
 5390= XX(77) = .15
 5400=C
 5410=C XX(95) IS USED IN EVENT(2), MUST BE LEFT EQUAL TO ZERO.
 5420=C

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5430=C      ** XX(99) IS THE TRACE SWITCH: 0=OFF, 1=ON
5440=      XX(99) = 0
5450=C
5460=      RETURN
5470=      END
5480=C
5490=C
5500=C*****
5510=      FUNCTION USERF(I)
5520=C
5530=      DIMENSION NSET(30000)
5540=      COMMON /SCOM1/ ATRIB(100),DD(100),DDL(100),DTNOW,II,MFA,
5550=      +MSTOP,NCLNR,NCRDR,NPRNT,NMRUN,NNSET,NTAPE,
5560=      +SS(100),SSL(100),TNEXT,TNOW,XX(100)
5570=      COMMON QSET(30000)
5580=      EQUIVALENCE (NSET(1),QSET(1))
5590=C
5600=      GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,
5610=      +22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37),I
5620=C
5630=C      THESE ALGORITHMS PREPARED FOR DEMONSTRATION OF THE MODEL MUST BE
5640=C      REWRITTEN TO REFLECT THE USER'S SYSTEM OPERATION. THE VARIOUS
5650=C      USERFS SHOWN HERE DEMONSTRATE SEVERAL APPROACHES WHICH MIGHT BE
5660=C      USED IN THE VARIOUS AREAS.
5670=C
5680=C*****
5690=C      USERF(1) IS THE INPROCESSING TIME FOR OFFBASE DEPLOYING
5700=C      PERSONNEL. IT ASSUMES A MINIMUM TIME FOR ALL FRNS, AND ADDS A
5710=C      FACTOR FOR THE SIZE OF THE FRN. USERS MAY WISH TO ADJUST EITHER
5720=C      OF THE VALUES USED HERE. IF SO, THEY SHOULD REMEMBER THAT THE
5730=C      TIMES USED MUST BE EXPRESSED IN HOURS, NOT MINUTES.
5740=C
5750=C      THE PROCESS BEGINS BY DRAWING A RANDOM NUMBER FROM A UNIFORM (0,1)
5760=C      DISTRIBUTION. IT THEN USES THAT NUMBER TO DECIDE WHICH OF THREE
5770=C      CLASSES THIS FRN FITS- EITHER EASIER THAN NORMAL TO INPROCESS
5780=C      (25%), NORMAL (50%), OR HARDER THAN NORMAL (25%). DEPENDING UPON
5790=C      THE CLASS, THE APPROPRIATE FACTOR IS MULTIPLIED BY THE NUMBER OF
5800=C      PERSONNEL AND ADDED TO THE CONSTANT, GIVING A VALUE RETURNED AS
5810=C      THE INPROCESSING TIME IN HOURS.
5820=C
5830=C      XX(98) = DRAND(4)
5840=C      IF (XX(98).LT..25) THEN
5850=C          USERF = (.002 * ATRIB(3)) + .15
5860=C      ELSE IF (XX(98).LT..75) THEN
5870=C          USERF = (.006 * ATRIB(3)) + .15
5880=C      ELSE
5890=C          USERF = (.010 * ATRIB(3)) + .15
5900=C      END IF
5910=C      IF (XX(99).EQ.1) PRINT*, 'USERF(1) = ',USERF, ' AT TNOW = ',TNOW
5920=C      RETURN
5930=C

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5940=C#####
5950=C
5960=C  USERF(2) CALCULATES THE TIME REMAINING BEFORE THE FRN IS
5970=C  SCHEDULED TO ENTER THE PAX STAGING AREA. THIS IS DRIVEN BY THE
5980=C  SCHEDULED DEPARTURE TIME, THE EARLIEST TIME BILLETED FRNS MAY
5990=C  REPORT TO THE PAX STAGING AREA, THE TRANSIT TIME FROM THE

6000=C  RECEPTION POINT TO THE PAX STAGING AREA, AND THE CURRENT TIME.
6010=C  SHOULD THE CALCULATED TIME BE NEGATIVE, A NOTICE WILL BE PRINTED
6020=C  TO ALERT THE MANAGERS THAT EXCESSIVE DELAYS ARE OCCURRING IN THE
6030=C  RECEPTION POINT AREA, AND THE VALUE IS SET TO 0.0 TO PREVENT
6040=C  A FATAL ERROR IN FUTURE PROCESSING.
6050=C
6060=C
6070=2  USERF = ATRIB(2) - TNOW - XX(6) - XX(42)
6080=  IF (USERF.LT.0) THEN
6090=    PRINT$, 'AN FRN IS BEHIND SCHEDULE EXITING THE RECEPTION POINT'
6100=    PRINT$, 'AT TNOW = ', TNOW
6110=    USERF = 0
6120=  END IF
6130=  IF (XX(99).EQ.1) PRINT$, 'USERF(2) = ', USERF, ' AT TNOW = ', TNOW
6140=  RETURN
6150=C
6160=C#####
6170=C
6180=C  USERF(3) THROUGH (7) CALCULATE THE NUMBER OF BUSES NEEDED. THESE
6190=C  CALCULATIONS ARE DRIVEN BY THE NUMBER OF PERSONS BEING SENT TO
6200=C  EACH OF THE BILLETING AREAS, AS REFLECTED BY ATTRIBUTES 12-16.
6210=C  THE ALGORITHM ASSUMES THAT EACH UNIT OF "BUS" RESOURCE IS A
6220=C  40- PAX BUS WHICH CAN HOLD UP TO 49 PAX IN A PINCH. THEREFORE,
6230=C  IF AN FRN HAS 9 PASSENGERS OVER A FULL BUS LOAD, THOSE 9 WILL
6240=C  BE EXPECTED TO SQUEEZE IN SOMEHOW. IF THERE ARE 10 PAX OVER A
6250=C  FULL BUSLOAD, ANOTHER BUS WILL BE ALLOCATED. ANY FRACTION OF
6260=C  A SINGLE BUSLOAD (EVEN ONE SINGLE INDIVIDUAL) WILL BE GIVEN A
6270=C  BUS TO HIM- OR HERSELF.
6280=C
6290=C  THE ALGORITHM USES INTEGER DIVISION, KEYING ON THE APPROPRIATE
6300=C  ATTRIBUTE VALUE AND THE ASSUMPTION THAT EACH BUS HAS A NORMAL
6310=C  CAPACITY OF 40. AFTER DIVIDING THE ATTRIBUTE BY 40, IT ADDS .75
6320=C  TO PUSH THE FIGURE OVER THE NEXT INTEGER IF THERE ARE MORE THAN
6330=C  9 PAX OVER A FULL BUSLOAD. IT THEN TRUNCATES THE DECIMAL PART,
6340=C  RETURNING THE INTEGER VALUE.
6350=C
6360=3  USERF = INT(ATRIB(12)/40 + .75)
6370=  IF (USERF.LT.1) USERF = 1
6380=  IF (XX(99).EQ.1) PRINT$, 'ATRIB(12) = ', ATRIB(12), ' USERF = ', USERF
6390=  RETURN
6400=C
6410=C
6420=4  USERF = INT(ATRIB(13)/40 + .75)
6430=  IF (USERF.LT.1) USERF = 1
6440=  IF (XX(99).EQ.1) PRINT$, 'ATRIB(13) = ', ATRIB(13), ' USERF = ', USERF
6450=  RETURN

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6460=C
6470=C
6480=C
6490=C
6500=C
6510=C
6520=C
6530=C
6540=C
6550=C
6560=C
6570=C
6580=C
6590=C
6600=C
6610=C
6620=C
6630=C
6640=C
6650=C*****
6660=C
6670=C
6680=C
6690=C
6700=C
6710=C
6720=C
6730=C
6740=C
6750=C
6760=C
6770=C
6780=C
6790=C
6800=C
6810=C
6820=C
6830=C
6840=C
6850=C
6860=C
6870=C
6880=C
6890=C
6900=C
6910=C
6920=C
6930=C
6940=C
6950=C

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USERF = INT(ATRIB(14)/40 + .75)
 IF (USERF.LT.1) USERF = 1
 IF ((X(99).EQ.1) PRINT*, 'ATRIB(14) = ', ATRIB(14), ' USERF = ', USERF
 RETURN

USERF = INT(ATRIB(15)/40 + .75)
 IF (USERF.LT.1) USERF = 1
 IF ((X(99).EQ.1) PRINT*, 'ATRIB(15) = ', ATRIB(15), ' USERF = ', USERF
 RETURN

USERF = INT(ATRIB(16)/40 + .75)
 IF (USERF.LT.1) USERF = 1
 IF ((X(99).EQ.1) PRINT*, 'ATRIB(16) = ', ATRIB(16), ' USERF = ', USERF
 RETURN

USERF(8) CALCULATES THE TIME THAT THE FRN HAS REMAINING IN THE
 TRANSIENT BILLETING AREA. THIS FIGURE IS DRIVEN BY THE SCHEDULED
 DEPARTURE TIME, THE CURRENT TIME, THE EARLIEST TIME BILLETED
 FRNS SHOULD ENTER PAX STAGING, AND THE TRANSIT TIME FROM EACH
 BILLETING AREA TO THE PAX STAGING AREA. SHOULD THE TIME
 REMAINING BE NEGATIVE, A NOTICE IS PRINTED TO ALERT THE
 MANAGERS TO EXCESSIVE DELAYS IN TRANSPORTATION.
 NOTE THAT WHEN AN FRN IS SPLIT AMONG SEVERAL AREAS BY ALLOC(1),
 IT IN EFFECT BECOMES SEVERAL FRNS. EACH HAS THE SAME
 CHARACTERISTICS (DEPARTURE TIME, ETC), BUT FROM THIS POINT
 ON THE TOTAL PAX FIGURE (ATRIB(3)) IS MEANINGLESS UNLESS
 THE FRN DID NOT GO THROUGH BILLETING (ATRIBS(12)-(16) = 0)

ALSO NOTE THAT WHEN AN FRN IS SPLIT AMONG MORE THAN ONE AREA,
 THE ATRIBUTES REFLECTING PARTS OF IT IN OTHER AREAS ARE ZEROED
 OUT, SO THAT THE AREA A PARTICULAR PART OF AN FRN IS ASSIGNED
 TO CAN BE READILY IDENTIFIED.

IF (ATRIB(12).GT.0) THEN
 USERF = ATRIB(2) - TNOW - XI(6) - XI(36)
 ELSE IF (ATRIB(13).GT.0) THEN
 USERF = ATRIB(2) - TNOW - XI(6) - XI(37)
 ELSE IF (ATRIB(14).GT.0) THEN
 USERF = ATRIB(2) - TNOW - XI(6) - XI(38)
 ELSE IF (ATRIB(15).GT.0) THEN
 USERF = ATRIB(2) - TNOW - XI(6) - XI(39)
 ELSE IF (ATRIB(16).GT.0) THEN
 USERF = ATRIB(2) - TNOW - XI(6) - XI(40)
 END IF

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6960=          IF (USERF.LT.0) THEN
6970=              PRINT$, 'FRN HAS NEGATIVE TIME REMAINING IN BILLETING'
6980=              PRINT$, 'UPON ARRIVAL AT ', TNOW
6990=              USERF = 0.0
7000=          END IF
7010=          IF (XX(99).EQ.1) PRINT$, 'TIME LEFT IN BILLETING = ', USERF
7020=          RETURN
7030=C
7040=C
7050=C*****
7060=C
7070=C          USERF(9) CALCULATES THE PROCESSING TIME NEEDED IN PASSENGER
7080=C          STAGING. THE LOGIC IS IDENTICAL TO THAT USED IN USERF(1), WITH
7090=C          THE EXCEPTION THAT WE MUST NOW KEY ON ATRIBS (12)-(16) IF THEY
7100=C          ARE NON-ZERO (THAT IS, IF THE FRN CAME THROUGH BILLETING, THE
7110=C          VALUE IN ATRIB(3) IS NO LONGER MEANINGFUL). THEREFORE, THE
7120=C          ALGORITHM FIRST CHECKS ATRIBS (12) - (13) FOR THE MAX VALUE.
7130=C          IT THEN CHECKS TO SEE IF THIS VALUE IS >0. IF SO, THE FRN
7140=C          CAME THROUGH BILLETING AND THIS IS THE NUMBER OF PEOPLE IN THIS
7150=C          GROUP (RECALL THAT NO MORE THAN ONE OF THE ATRIB (12)-(16) SET
7160=C          MAY BE NON-ZERO AT THIS POINT). IF THE MAX VALUE OBTAINED IS 0,
7170=C          THE FRN DID NOT GO THROUGH BILLETING AND WE MAY SAFELY USE
7180=C          ATRIB(3) AS THE NUMBER OF PEOPLE IN THIS GROUP.
7190=C
7200=C          HERE AGAIN, THE USERS MAY WISH TO CHANGE THE VALUES IN THE
7210=C          EQUATION, AND THEY ARE REMINDED THAT THESE FIGURES REPRESENT
7220=C          HOURS, NOT MINUTES.
7230=C
7240=C          II=MAX(ATRIB(12),ATRIB(13),ATRIB(14),ATRIB(15),ATRIB(16))
7250=C          IF (II.EQ.0) II=ATRIB(3)
7260=C          XX(98) = DRAND(4)
7270=C          IF (XX(98).LT..25) THEN
7280=C              USERF = .50 + (.010 * II)
7290=C          ELSE IF (XX(98).LT..75) THEN
7300=C              USERF = .50 + (.015 * II)
7310=C          ELSE
7320=C              USERF = .50 + (.020 * II)
7330=C          END IF
7340=C          IF (XX(99).EQ.1) PRINT$, 'XX(98)/ II/ USERF(9) = ', XX(98), II, USERF
7350=C          RETURN
7360=C
7370=C
7380=C*****
7390=C
7400=C          USERF(10) CALCULATES THE TIME REMAINING IN PAX STAGING UPON
7410=C          COMPLETION OF PROCESSING. THIS IS DRIVEN BY THE SCHEDULED
7420=C          DEPARTURE TIME, THE EARLIEST TIME FRNS MAY REPORT TO THE PAX
7430=C          TERMINAL, AND THE TRANSIT TIME FROM PAX STAGING TO THE TERMINAL.
7440=C          IF THE TIME REMAINING IS NEGATIVE, A NOTICE IS PRINTED TO ALERT
7450=C          THE MANAGERS THAT AN FRN IS BEHIND SCHEDULE AT THIS POINT.
7460=C

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7470=C      NOTE THAT THIS IS A FUNCTION OF THE PARAMETER ESTABLISHED BY THE
7480=C      USER IN XX(45), THE EARLIEST TIME AN FRN MAY GO TO THE TERMINAL.
7490=C      THEREFORE, IF XX(45) IS SET VERY LARGE, THE FRNS WILL BE MOVED TO
7500=C      TERMINAL SOONER THAN IF IT IS SMALL. AS A CONSEQUENCE, MORE OF
7510=C      THEM WILL BE UNABLE TO MAKE THIS MOVE ON SCHEDULE, DUE TO EARLIER
7520=C      DELAYS. HOWEVER, BY SETTING XX(45) TO A LARGE VALUE, THERE IS A
7530=C      GREATER AMOUNT OF SLACK IN THE TERMINAL AREA, AND IT IS VERY
7540=C      LIKELY THAT AN FRN COULD SHOW UP AS 'LATE' GETTING TO THE
7550=C      TERMINAL, BUT STILL MAKE ITS SCHEDULED DEPARTURE.
7560=C      THE .0001 AND .00001 FACTORS ARE NEEDED TO OVERCOME PROBLEMS
7570=C      CAUSED BY INTERNAL ROUNDING ERROR IN THE COMPUTER.
7580=C
7590=10      USERF = ATRIB(2) - TNOW - XX(45) - XX(44) + .00001
7600=        IF (USERF.LT.0) THEN
7610=          PRINT*, 'FRN HAS NEGATIVE TIME REMAINING UPON EXIT FROM'
7620=          PRINT*, 'PAX STAGING AREA AT TIME = ', TNOW
7630=          USERF = 0
7640=        END IF
7650=        IF (USERF.LT..0001) USERF = 0
7660=        IF (XX(99).EQ.1) PRINT*, 'USERF(10) = ', USERF
7670=        RETURN
7680=C
7690=C
7700=C      *****
7710=C
7720=C      USERF(11) CALCULATES THE NUMBER OF BUSES NEEDED BY THIS GROUP TO
7730=C      MOVE INTO AND OUT OF THE TERMINAL. IT USES THE SAME LOGIC AS WAS
7740=C      USED IN USERF(3) - (7), WITH THE ADDED NECESSITY OF DETERMINING
7750=C      WHETHER TO USE ATRIB(3) OR ONE OF THE VALUES IN ATRIB(12) - (16).
7760=C
7770=11      II = MAX(ATRIB(12), ATRIB(13), ATRIB(14), ATRIB(15), ATRIB(16))
7780=        IF (II.EQ.0) II = ATRIB(3)
7790=        USERF = INT(II/40.0 + .75)
7800=        IF (USERF.LT.1) USERF = 1
7810=        IF (XX(99).EQ.1) PRINT*, 'II = ', II, ', USERF(11) = ', USERF
7820=        RETURN
7830=C
7840=C
7850=C      *****
7860=C
7870=C      USERF(12) CALCULATES THE PROCESSING TIME NEEDED IN THE PASSENGER
7880=C      TERMINAL. THE LOGIC IS IDENTICAL TO THAT FOR THE PAX STAGING
7890=C      PROCESSING TIME (USERF(9)), AND ALL COMMENTS FOR THAT USERF APPLY
7900=C      HERE AS WELL.
7910=C

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7920=12      II=MAX(ATRIB(12),ATRIB(13),ATRIB(14),ATRIB(15),ATRIB(16))
7930=        IF (II.EQ.0) II=ATRIB(3)
7940=        XX(98) = DRAND(4)
7950=        IF (XX(98).LT..25) THEN
7960=            USERF = .50 + (.010 * II)
7970=        ELSE IF (XX(98).LT..75) THEN
7980=            USERF = .50 + (.015 * II)
7990=        ELSE
8000=            USERF = .50 + (.020 * II)
8010=        END IF
8020=        IF (XX(99).EQ.1) PRINT*, 'XX(98)/ II/ USERF(12) = ', XX(98), II, USERF
8030=        RETURN
8040=C
8050=C
8060=C*****
8070=C
8080=C        USERF(13) CHECKS TO SEE WHICH AREA THIS FRN IS GOING TO, AND
8090=C        ASSIGNS THE APPROPRIATE TRANSIT TIME FROM THOSE PREVIOUSLY
8100=C        ESTABLISHED BY THE USER IN THE XX(.) ARRAY.
8110=C
8120=13      IF (ATRIB(12).GT.0) USERF = XX(26)
8130=        IF (ATRIB(13).GT.0) USERF = XX(27)
8140=        IF (ATRIB(14).GT.0) USERF = XX(28)
8150=        IF (ATRIB(15).GT.0) USERF = XX(29)
8160=        IF (ATRIB(16).GT.0) USERF = XX(30)
8170=        IF (XX(99).EQ.1) PRINT*, 'USERF(13) = ', USERF
8180=        RETURN
8190=C
8200=C
8210=C*****
8220=C
8230=C        USERF(14) CHECKS TO SEE FROM WHICH AREA THIS FRN IS COMING, AND
8240=C        ASSIGNS THE APPROPRIATE TRANSIT TIME FROM THOSE PREVIOUSLY
8250=C        ESTABLISHED BY THE USER IN THE XX(.) ARRAY.
8260=C
8270=14      IF (ATRIB(12).GT.0) USERF = XX(36)
8280=        IF (ATRIB(13).GT.0) USERF = XX(37)
8290=        IF (ATRIB(14).GT.0) USERF = XX(38)
8300=        IF (ATRIB(15).GT.0) USERF = XX(39)
8310=        IF (ATRIB(16).GT.0) USERF = XX(40)
8320=        IF (XX(99).EQ.1) PRINT*, 'USERF(14) = ', USERF
8330=        RETURN
8340=C
8350=C
8360=C*****
8370=C
8380=C        USERF(15) IS NOT USED
8390=15      RETURN
8400=C

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8410=C*****
8420=C
8430=C
8440=C  USERF(16) AND (17) CALCULATE THE TIME REMAINING IN THE TERMINAL
8450=C  FOLLOWING THE COMPLETION OF FINAL PROCESSING. THE FIRST IS USED
8460=C  FOR THOSE FRNS WHO WILL BE WALKING TO THEIR AIRCRAFT, AND THE
8470=C  SECOND FOR THOSE WHO WILL REQUIRE BUS TRANSPORT. NOTE THAT THESE
8480=C  FACTORS ARE SET BY THE USER AS PERCENTAGES IN XX(46).
8490=C  THIS IS INCLUDED TO ALLOW FOR DIFFERENT AIRFIELD LAYOUTS, IN
8500=C  WHICH SOME PARKING SPOTS MAY BE CLOSE TO THE TERMINAL AND OTHERS
8510=C  ARE FAR AWAY. ALSO, POLICY CHANGES MAY BE MODELLED. FOR INSTANCE,
8520=C  BASE X MAY DECIDE THAT IN GOOD WEATHER ALL AIRCRAFT WILL BE
8530=C  WITHIN WALKING DISTANCE, WHILE IN BAD WEATHER (SUCH AS WINTER)
8540=C  ONLY 2 OUT OF 10 (20%) AIRCRAFT WILL BE PARKED WITHIN WALKING
8550=C  DISTANCE. EACH OF THESE POLICIES COULD BE EXAMINED FOR THE IMPACT
8560=C  ON THE BUS RESOURCE, AND WHETHER THE RESOURCES AVAILABLE WILL BE
8570=C  ENOUGH.
8580=C
8590=C  HERE AGAIN, IF THE TIME REMAINING IS NEGATIVE, A MESSAGE IS
8600=C  PRINTED TO ALERT THE MANAGERS THAT FRNS ARE BEHIND SCHEDULE AT
8610=C  THIS POINT. IT IS POSSIBLE THAT ALL FRNS COULD BE ON SCHEDULE UP
8620=C  TO THIS POINT, AND STILL BE LATE REACHING THEIR AIRCRAFT DUE TO
8630=C  THE STRUCTURE OF THE MODEL. AN FRN WHICH IS TO BE BUSED TO THE
8640=C  AIRCRAFT WILL NOT PRESENT ITSELF FOR BUS ALLOCATION UNTIL XX(47)
8650=C  HOURS PRIOR TO ITS SCHEDULED DEPARTURE FROM THE SYSTEM, WHERE
8660=C  XX(47) IS SET BY THE USER TO BE THE AVERAGE TRANSIT TIME BY BUS
8670=C  TO THE AIRCRAFT. THEREFORE, IF THE FRN NEEDS MORE BUSES THAN ARE
8680=C  AVAILABLE AT THAT MOMENT, IT WILL BE SOMEWHAT LATE IN GETTING TO
8690=C  THE AIRCRAFT. SINCE THE 'SCHEDULED DEPARTURE TIME' USED THROUGH-
8700=C  OUT THIS MODEL REFERS TO DEPARTURE FROM THE RECEPTION SYSTEM,
8710=C  (WHICH IS ACTUALLY THE FRN'S ARRIVAL AT THE AIRCRAFT), SOME DELAY
8720=C  IS ACCEPTABLE SINCE THEY SHOULD BE LOADING SOME 1-2 HOURS PRIOR
8730=C  TO WHEELS UP.
8740=C
8750=C
8760=16  USERF = ATTRIB(2) - XX(49) - TNOW
8770=    IF (USERF.LT.0) THEN
8780=        PRINT$, 'FRN HAS NEGATIVE TIME REMAINING UPON FINISH OF'
8790=        PRINT$, 'PAX TERMINAL PROCESSING AT TIME = ', TNOW
8800=        USERF=0
8810=    END IF
8820=    IF (XX(99).EQ.1) PRINT$, 'USERF(16) = ', USERF, ', TNOW = ', TNOW
8830=    RETURN
8840=C
8850=C
8860=17  USERF = ATTRIB(2) - XX(47) - TNOW
8870=    IF (USERF.LT.0) THEN
8880=        PRINT$, 'FRN HAS NEGATIVE TIME REMAINING UPON FINISH OF'
8890=        PRINT$, 'PAX TERMINAL PROCESSING AT TIME = ', TNOW
8900=        USERF = 0
8910=    END IF

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8920=      IF (XX(99).EQ.1) PRINT$, 'USERF(17) = ', USERF, ', TNOW = ', TNOW
8930=      RETURN
8940=C
8950=C*****
8960=C
8970=C
8980=C      USERF(18) CALCULATES THE NUMBER OF VEHICLES IN THIS FRN. THIS IS
8990=C      AN ESTIMATE BASED ON THE ESTIMATED VEHICULAR STONS (ATIB(5)) AND
9000=C      ON THE ESTIMATED AVERAGE VEHICLE WEIGHT (XX(53)).
9010=C
9020=C      SINCE USERF(18) MAY BE CALLED AFTER AN FRN HAS UNDERGONE JOINT
9030=C      INSPECTION, THE ALGORITHM KEYS ON ATIB(3) TO DETERMINE IF SUCH IS
9040=C      THE CASE. IF SO, THE NUMBER OF VEHICLES IS FOUND IN ATIB(3),
9050=C      WHICH IS THE NUMBER THAT HAD FAILED THE INSPECTION. IF NOT, THE
9060=C      NUMBER IS CALCULATED BASED ON THE ABOVE ESTIMATES.
9070=C
9080=18      IF (ATIB(3).EQ.0) THEN
9090=          USERF = MAX(NINT(ATIB(5)/XX(53)),1)
9100=          ELSE
9110=              USERF = ATIB(3)
9120=      END IF
9130=      IF (XX(99).EQ.1) PRINT$, 'USERF(18) = ', USERF, ' TIME = ', TNOW
9140=      RETURN
9150=C
9160=C*****
9170=C
9180=C      USERF(19) CALCULATES THE CARGO INPROCESSING TIME, BASED ON THE
9190=C      TOTAL AMOUNT OF CARGO (ATIB(4)). THE TIME IS EXPRESSED IN HOURS.
9200=C
9210=19      USERF = ATIB(4) * .10
9220=      IF (XX(99).EQ.1) PRINT$, 'USERF(19) = ', USERF, ' TIME = ', TNOW
9230=      RETURN
9240=C
9250=C*****
9260=C
9270=C      USERF(20) CALCULATES THE TIME BEFORE SCHEDULED DEPARTURE. IF IT IS
9280=C      NEGATIVE, A WARNING MESSAGE IS PRINTED AND IT IS SET TO ZERO.
9290=C
9300=20      USERF = ATIB(2) - TNOW
9310=      IF (USERF.LT.0) THEN
9320=          PRINT$, 'CARGO HAS NEGATIVE TIME REMAINING UPON COMPLETION OF'
9330=          PRINT$, 'VEHICLE PROCESSING AT TIME = ', TNOW
9340=          USERF = 0
9350=      END IF
9360=      IF (XX(99).EQ.1) PRINT$, 'USERF(20) = ', USERF, ' TIME = ', TNOW
9370=      RETURN
9380=C

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9390=C*****
9400=C
9410=C  USERF(21) CALCULATES THE TIME REMAINING BEFORE THE CARGO SHOULD
9420=C  BE MOVED TO JOINT INSPECTION. IF THIS TIME IS NEGATIVE, IT IS SET
9430=C  TO ZERO.
9440=C
9450=21  USERF = ATRIB(2) - TNOW - XX(64)
9460=    IF (USERF.LT.0) USERF = 0
9470=    IF (XX(99).EQ.1) PRINT*, 'USERF(21) = ', USERF, ' TIME = ', TNOW
9480=    RETURN
9490=C
9500=C*****
9510=C
9520=C  USERF(22) IS THE VEHICLE INSPECTION TIME, AND IS SIMPLY PULLED
9530=C  FROM A TRIANGULAR DISTRIBUTION.
9540=C
9550=22  USERF = TRIAG(.25,.50,.75,5)
9560=    IF (XX(99).EQ.1) PRINT*, 'USERF(22) = ', USERF, ' TIME = ', TNOW
9570=    RETURN
9580=C
9590=C*****
9600=C
9610=C  USERF(23) CONVERTS THE NUMBER OF VEHICLES THAT PASSED JI BACK INTO
9620=C  SHORT TONS, SINCE THE MARSHALLING AREA CAPACITY IS MEASURED IN
9630=C  TONS. THIS FIGURE MAY NOT MATCH THE VEHICULAR CARGO WEIGHT THAT
9640=C  THE FRN STARTED OUT WITH, BUT THE DIFFERENCE (WHICH IS DUE TO
9650=C  ROUNDING ERROR) SHOULD NOT BE TOO GREAT.
9660=C
9670=23  USERF = ATRIB(4) * XX(53)
9680=    IF (XX(99).EQ.1) PRINT*, 'USERF(23) = ', USERF, ' TIME = ', TNOW
9690=    RETURN
9700=C
9710=C*****
9720=C
9730=C  USERF(24) CALCULATES THE TIME LEFT IN THE MARSHALLING AREA AFTER
9740=C  JI IS FINISHED. IF THIS TIME IS NEGATIVE, A MESSAGE IS PRINTED AND
9750=C  THE TIME IS SET TO ZERO.
9760=C
9770=24  USERF = ATRIB(2) - TNOW
9780=    IF (USERF.LT.0) THEN
9790=      PRINT*, 'CARGO HAS NEGATIVE TIME REMAINING UPON COMPLETION OF'
9800=      PRINT*, 'JOINT INSPECTION AT TIME = ', TNOW
9810=      USERF=0
9820=    END IF
9830=    IF (XX(99).EQ.1) PRINT*, 'USERF(24) = ', USERF, ' TIME = ', TNOW
9840=    RETURN
9850=C

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9860=C*****
9870=C
9880=C    USERF(25) CALCULATES THE NUMBER OF PALLETS IN THIS FRN BASED ON
9890=C    THE ESTIMATED NON-VEHICULAR CARGO TONNAGE AND THE ESTIMATED
9900=C    AVERAGE PALLET WEIGHT.
9910=C
9920=C    USERF = MAX(NINT(ATTRIB(6)/XX(54)),1)
9930=C    IF (XX(99).EQ.1) PRINT*, 'USERF(25) = ', USERF, ' TIME = ', TNOW
9940=C    RETURN
9950=C
9960=C*****
9970=C
9980=C    USERF(26) IS THE PROCESSING TIME NEEDED IN THE UNIT ASSEMBLY
9990=C    AREA(S), BASED ON THE NUMBER OF PALLETS TO BE PROCESSED.
10000=C
10010=C    USERF = ATTRIB(17) * .25
10020=C    IF (XX(99).EQ.1) PRINT*, 'USERF(26) = ', USERF, ' TIME = ', TNOW
10030=C    RETURN
10040=C
10050=C*****
10060=C
10070=C    USERF(27) CALCULATES THE TRANSIT TIME FROM THE UNIT ASSEMBLY AREA
10080=C    TO JOINT INSPECTION, BASED ON WHICH AREA THE CARGO IS IN.
10090=C
10100=C    IF (ATTRIB(12).GT.0) USERF= XX(67)
10110=C    IF (ATTRIB(13).GT.0) USERF= XX(68)
10120=C    IF (ATTRIB(14).GT.0) USERF= XX(69)
10130=C    IF (ATTRIB(15).GT.0) USERF= XX(70)
10140=C    IF (ATTRIB(16).GT.0) USERF= XX(71)
10150=C    IF (XX(99).EQ.1) PRINT*, 'USERF(27) = ', USERF, ' TIME = ', TNOW
10160=C    RETURN
10170=C
10180=C*****
10190=C
10200=C    USERF(28) IS THE PALLET INSPECTION TIME, AND IS DRAWN FROM A
10210=C    TRIANGULAR DISTRIBUTION.
10220=C
10230=C    USERF=TRIANG(.08,.165,.25,7)
10240=C    IF (XX(99).EQ.1) PRINT*, 'USERF(28) = ', USERF, ' TIME = ', TNOW
10250=C    RETURN
10260=C
10270=C*****
10280=C
10290=C    USERF(29) IS THE NUMBER OF PALLETS THAT PASSED JI, CONVERTED INTO
10300=C    SHORT TONS. AS WITH THE VEHICLES, THE TONNAGE MAY NOT MATCH THE
10310=C    ORIGINAL FIGURE DUE TO ROUNDING ERROR.
10320=C
10330=C    USERF = ATTRIB(4) * XX(54)
10340=C    IF (XX(99).EQ.1) PRINT*, 'USERF(29) = ', USERF, ' TIME = ', TNOW
10350=C    RETURN
10360=C

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10370=C*****
10380=C
10390=C   USERF(30) IS THE TIME NEEDED TO REWORK FRUSTRATED PALLETS.
10400=C
10410=30   USERF=TRIAB(.15,.20,.50,7)
10420=     IF (XX(99).EQ.1) PRINT*, 'USERF(30) = ', USERF, ' TIME = ', TNOW
10430=     RETURN
10440=C
10450=C*****
10460=C
10470=C   USERF(31) IS NOT USED.
10480=31   RETURN
10490=C
10500=C*****
10510=C
10520=C   USERF(32) IS THE TIME TO LOAD OR UNLOAD THE PALLETS ONTO OR OFF OF
10530=C   THE FLATBED, AND DEPENDS ON HOW MANY PALLETS THERE ARE.
10540=C
10550=32   USERF = ATRIB(18) * .10
10560=     IF (XX(99).EQ.1) PRINT*, 'USERF(32) = ', USERF, ' TIME = ', TNOW
10570=     RETURN
10580=C
10590=C*****
10600=C
10610=C   USERF(33) IS THE DELAY BEFORE ONBASE NONVEHICULAR URC IS
10620=C   ALLOWED TO MOVE TO THE MARSHALLING AREA.
10630=C
10640=33   USERF = ATRIB(2) - TNOW - 6.0
10650=     IF (USERF.LT.0) USERF = 0
10660=     IF (XX(99).EQ.1) PRINT*, 'USERF(33) = ', USERF, ' TIME = ', TNOW
10670=     RETURN
10680=C
10690=C*****
10700=C
10710=C   USERF(34) IS THE PROCESSING TIME FOR OFFBASE NRC IN THE SURFACE
10720=C   FREIGHT SECTION, WHICH INVOLVES ONLY PAPERWORK. THIS INCLUDES
10730=C   ONBASE NRC ALSO IF THE SWITCH XX(76) WAS SET TO 1.
10740=C
10750=34   USERF = (.1 * ATRIB(4)) + 1.0
10760=     IF (XX(99).EQ.1) PRINT*, 'USERF(34) = ', USERF, ' TIME = ', TNOW
10770=     RETURN
10780=C
10790=C*****
10800=C
10810=C   USERF(35) CALCULATES THE TIME REMAINING AFTER THE COMPLETION OF
10820=C   NRC PROCESSING. IF NEGATIVE, IT IS SET TO 0 AND A MESSAGE IS
10830=C   PRINTED.
10840=C

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10850=35  USERF = ATRIB(2) - TNOW
10860=    IF (USERF.LT.0) THEN
10870=      PRINT*, 'CARGO HAS NEGATIVE TIME REMAINING UPON COMPLETION OF'
10880=      PRINT*, 'NRC PROCESSING AT TIME = ', TNOW
10890=      USERF = 0.0
10900=    END IF
10910=    IF (XX(99).EQ.1) PRINT*, 'USERF(35) = ', USERF, ' TIME = ', TNOW
10920=    RETURN
10930=C
10940=C*****
10950=C
10960=C  USERF(36) CALCULATES THE TIME REMAINING UPON ENTRY INTO THE NRC
10970=C  TERMINAL (AFTER THE ENTIRE LOAD IS UNLOADED). IF NEGATIVE, IT
10980=C  IS SET TO 0 AND A MESSAGE IS PRINTED.
10990=C
11000=36  USERF = ATRIB(2) - TNOW
11010=    IF (USERF.LT.0) THEN
11020=      PRINT*, 'CARGO HAS NEGATIVE TIME REMAINING AFTER BEING'
11030=      PRINT*, 'UNLOADED AT NRC TERMINAL AT TIME = ', TNOW
11040=      USERF = 0.0
11050=    END IF
11060=    IF (XX(99).EQ.1) PRINT*, 'USERF(36) = ', USERF, ' TIME = ', TNOW
11070=    RETURN
11080=C
11090=C*****
11100=C
11110=C  USERF(37) TRANSFORMS THE TOTAL STONS FIGURE TO THE NEAREST
11120=C  INTEGER VALUE, NECESSARY FOR THE RESOURCE ALLOCATION ROUTINE.
11130=C
11140=37  USERF = MINT(ATRIB(4))
11150=    IF (XX(99).EQ.1) PRINT*, 'USERF(37) = ', USERF, ' TIME = ', TNOW
11160=    RETURN
11170=C
11180=C
11190=    END
11200=C
11210=C*****
11220=C
11230=    SUBROUTINE ALLOC(IAC, IFLAG)
11240=    DIMENSION NSET(30000)
11250=    COMMON /SCM1/ ATRIB(100), DD(100), DDL(100), DTNOW, II, MFA,
11260=    +MSTOP, NCLNR, NCRDR, NPRNT, NNRUN, NNSET, NTAPE,
11270=    +SS(100), SSL(100), TNEXT, TNOW, XX(100)
11280=    COMMON QSET(30000)
11290=    EQUIVALENCE (NSET(1), QSET(1))
11300=C
11310=    GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16), IAC
11320=C

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11330=C*****
11340=C
11350=C   ALLOC(1) ALLOCATES TRANSIENT BILLETING. THE BILLETING IS IN 5
11360=C   AREAS, LABELLED TRABIL1- TRABIL5. THE LABELS CORRESPOND TO THE
11370=C   PREFERENCE THAT THE MANAGERS WILL GIVE TO THE AREAS. IN OTHER
11380=C   WORDS, AREA 1 WOULD NORMALLY BE USED BEFORE AREA 2, AND SO ON. IT
11390=C   IS NOT NECESSARY THAT ALL FIVE AREAS BE USED. IF A PARTICULAR BASE
11400=C   ONLY ESTABLISHES THREE AREAS, THEN THE USER NEED ONLY SET THE
11410=C   AVAILABILITY OF AREAS 4 AND 5 TO ZERO ON THE 'RESOURCE' CARD IN
11420=C   THE NETWORK PORTION OF THE INPUT. THIS WILL PREVENT THE MODEL FROM
11430=C   EVER ASSIGNING ANY FRN TO THOSE AREAS.
11440=C
11450=C   IN DEFINING THE AVAILABILITY OF BILLETING, THE 'UNIT OF ISSUE' IS
11460=C   ONE SLEEPING SPACE. THIS ASSUMES THAT THE ASSOCIATED SERVICES ARE
11470=C   PROVIDED AS WELL (SANITARY FACILITIES, TRASH REMOVAL, ETC.). IN
11480=C   SOME CASES, THE MANAGERS MAY ESTABLISH A 'WARM BUNK' POLICY IN
11490=C   WHICH TWO OR THREE PERSONS MAY USE THE SAME BUNK IN ROTATION. IN
11500=C   SUCH CASES, THE AVAILABILITY SHOULD BE LISTED AS THE NUMBER OF
11510=C   PERSONS USING THE AREA, NOT THE NUMBER OF BEDS. (FOR INSTANCE, IN
11520=C   AN 8- HOUR ROTATION OF THIRTY BEDS, THE AVAILABILITY WOULD BE 90
11530=C   BEDS, SINCE THREE GROUPS OF THIRTY PEOPLE COULD BE HANDLED.)
11540=C
11550=C   THE ALLOCATION OF BILLETING, AS HANDLED BY ALLOC(1), USES THE
11560=C   RESOURCE NUMBERS ASSIGNED INTERNALLY BY SLAM. TRABIL1 IS RESOURCE
11570=C   #12, TRABIL2 IS #13, TRABIL3 IS #14, TRABIL4 IS #15, AND TRABIL5
11580=C   IS #16. THESE NUMBERS ARE USED IN THE DO-LOOPS AS INDEXES, AND
11590=C   ARE PASSED TO THE ATTRIBUTE ARRAY AS THE AREA TO WHICH THE FRN WAS
11600=C   ASSIGNED. AFTER THE ALLOCATION, ATTRIBUTE 12 IS THE NUMBER OF UNITS
11610=C   OF TRABIL1 RECEIVED, ATTRIBUTE 13 IS THE NUMBER FROM TRABIL2, ATRIB
11620=C   (14) IS THE NUMBER FROM TRABIL3, ATRIB(15) IS THE NUMBER FROM
11630=C   TRABIL4, AND ATRIB(16) IS THE NUMBER FROM TRABIL5. DUE TO THIS USE
11640=C   OF THE INTERNAL RESOURCE NUMBERS, THE RESOURCE STATEMENTS IN THE
11650=C   FIRST PART OF THE NETWORK MUST REMAIN IN THE ORIGINAL ORDER, OR
11660=C   ELSE ALL BETS ARE OFF.
11670=C
11680=C   THE FIRST STEP IN THE ALLOCATION IS A RE-EXAMINATION OF THE TIME
11690=C   REMAINING BEFORE DEPARTURE. IF THE FRN HAS BEEN WAITING TOO LONG,
11700=C   THERE IS NO LONGER ANY POINT IN SENDING THEM TO BILLETING. THEY
11710=C   ARE INSTEAD ROUTED BACK TO THE NETWORK, WHICH SENDS THEM TO PAX
11720=C   STAGING.
11730=1   ATRIB(11) = ATRIB(2) - TNOW
11740=   IF (ATTRIB(11).LT.XX(8)) THEN
11750=       IFLAG = 1
11760=       PRINT*, 'FRN RELEASED FROM BILLET QUEUE AT TIME = ', TNOW
11770=       RETURN
11780=   END IF
11790=C

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11800=C      IF THERE IS STILL ENOUGH TIME TO BILLET THEM, WE FIRST TRY TO PUT
11810=C      THE ENTIRE FRN IN ONE AREA.
11820=C
11830=      II=ATRI(3)

11840=      DO 25 J=12,16
11850=          IF (NNRSC(J).GE.II) THEN
11860=              CALL SEIZE(J,II)
11870=              ATRI(J) = II
11880=              IFLAG = 1
11890=              RETURN
11900=          END IF
11910=25      CONTINUE
11920=C
11930=C      FAILING TO PUT THEM INTO ONE AREA, WE NEXT CHECK TO SEE IF THERE
11940=C      ARE ENOUGH SPACES IN ALL AREAS COMBINED.
11950=C
11960=C      IF THERE ARE NOT, THE FRN IS TOLD TO WAIT IN THE QUEUE. IF THERE
11970=C      ARE ENOUGH SLOTS SCATTERED AROUND, WE START BY ALLOCATING THE
11980=C      LARGEST CHUNK FIRST. THIS CONTINUES UNTIL THE ENTIRE FRN HAS BEEN
11990=C      BILLETED.
12000=C
12010=      II=NNRSC(12) + NNRSC(13) + NNRSC(14) + NNRSC(15) + NNRSC(16)
12020=      IF (II.LT.ATRI(3)) THEN
12030=          IFLAG = 0
12040=          RETURN
12050=      ELSE
12060=          NNEED = ATRI(3)
12070=100      II=MAX(NNRSC(12),NNRSC(13),NNRSC(14),NNRSC(15),NNRSC(16))
12080=          DO 20 K=12,16
12090=              IF(II.EQ.NNRSC(K)) THEN
12100=                  IF (II.LE.NNEED) THEN
12110=                      CALL SEIZE(K,II)
12120=                      ATRI(K) = II
12130=                      NNEED=NNEED-II
12140=                  ELSE
12150=                      CALL SEIZE(K,NNEED)
12160=                      ATRI(K)=NNEED
12170=                      NNEED=0
12180=                      IFLAG=1
12190=                      RETURN
12200=                  END IF
12210=              END IF
12220=20      CONTINUE
12230=      GO TO 100
12240=      END IF
12250=C
12260=C

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12270=C*****
12280=C
12290=C   ALLOC(2) IS THE BUS ALLOCATION ROUTINE, AND IS USED IN SEVERAL
12300=C   LOCATIONS. IN EVERY CASE, WHEN AN FRM ARRIVES AT A NODE TO RECEIVE
12310=C   BUSES, IT CARRIES WITH IT ATTRIBUTE 17, WHICH IS THE NUMBER OF
12320=C   BUSES IT NEEDS, AND ATTRIBUTE 18, WHICH IS THE NUMBER OF BUSES IT
12330=C   HAS AT THE MOMENT (0 TO START WITH). THE ROUTINE FIRST ATTEMPTS TO
12340=C   GIVE THE FRM ALL THE BUSES IT NEEDS AT ONE TIME. FAILING THIS, IT
12350=C   GIVES ALL THE BUSES THAT ARE AVAILABLE. IF NONE ARE AVAILABLE, THE
12360=C   FRM IS TOLD TO WAIT.
12370=C
12380=C   AS BUSES ARE ALLOCATED, ATTRIBUTE 17 IS DECREMENTED BY THAT NUMBER
12390=C   AND REPRESENTS THE NUMBER OF BUSLOADS OF PEOPLE STILL WAITING FOR
12400=C   TRANSPORTATION. AS SHOWN BY THE NETWORK DIAGRAM IN CHAPTER FOUR,
12410=C   AS LONG AS ATTRIBUTE 17 IS GREATER THAN 0, THE FRM WILL CONTINUE TO
12420=C   LOOP BACK TO THE AWAIT NODE TO RECEIVE THE BUSES IT STILL NEEDS.
12430=C
12440=C   THESE BUSES MAY COME FROM EITHER THE ONES IN USE BY THIS FRM,
12450=C   COMING BACK FOR A SECOND LOAD, OR FROM BUSES BEING RELEASED FROM
12460=C   OTHER PARTS OF THE NETWORK. WHICHEVER THE CASE, THEY ARE ALLOCATED
12470=C   AND ATRIB(18) SHOWS HOW MANY THE FRM CURRENTLY HAS. THIS IS THE
12480=C   NUMBER WHICH WILL BE RELEASED AFTER THE DURATION OF THE TRIP HAS
12490=C   ELAPSED. ONCE ATRIB(17) HAS BEEN DECREMENTED TO ZERO, SHOWING THAT
12500=C   THE ENTIRE FRM HAS BEEN MOVED, THE FRM IS ROUTED TO THE NEXT PART
12510=C   OF THE NETWORK.
12520=C
12530=C
12540=2   II=ATRIB(17)
12550=   IF (NNRSC(4).GE.II) THEN
12560=       CALL SEIZE(4,II)
12570=       ATRIB(17) = 0
12580=       ATRIB(18) = II
12590=       IFLAG = 1
12600=       RETURN
12610=   ELSE IF (NNRSC(4).GT.0) THEN
12620=       ATRIB(17) = ATRIB(17) - NNRSC(4)
12630=       ATRIB(18) = NNRSC(4)
12640=       CALL SEIZE(4,NNRSC(4))
12650=       IFLAG = 1
12660=       RETURN
12670=   ELSE
12680=       IFLAG = 0
12690=       RETURN
12700=   END IF
12710=C
12720=C

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12730=C:*****
12740=C
12750=C      ALLOC(3) ALLOCATES BILLET AREA FEEDING CAPABILITY. IN DEFINING
12760=C      THIS RESOURCE, THE MANAGERS MUST TAKE INTO ACCOUNT THE CAPABILITY
12770=C      OF SOME TRANSIENT FRNS TO FEED THEMSELVES. AS THIS THESIS IS BEING
12780=C      PREPARED, THIS CAPABILITY IS LARGELY A MYSTERY. WHEN IT BECOMES
12790=C      KNOWN THAT A GIVEN UNIT WILL ARRIVE ON A CERTAIN DAY AND WILL SET
12800=C      UP A FIELD KITCHEN FOR 15 DAYS, THE MODEL CAN BE MODIFIED TO TAKE
12810=C      INTO ACCOUNT THE INCREASED LEVEL OF FEEDING RESOURCE THAT SUCH A
12820=C      KITCHEN WOULD PROVIDE FOR THOSE 15 DAYS. AT THIS TIME, HOWEVER,
12830=C      THAT LEVEL OF DETAIL IS NOT ATTEMPTED. THE MANAGERS SHOULD MERELY
12840=C      ATTEMPT TO DEFINE THE NUMBER OF MEALS THEY COULD SERVE AT EACH
12850=C      AREA. FOR THIS RESOURCE, EACH AREA IS CONSIDERED SEPERATE, EVEN
12860=C      THOUGH A SINGLE SOURCE MIGHT PROVIDE MEALS FOR ALL BILLETING
12870=C      AREAS. IN SUCH A CASE, THE AVAILABILITY SHOULD BE DIVIDED AMONG
12880=C      THE SEVERAL AREAS. FURTHERMORE, THE AVAILABILITY OF MEALS IS
12890=C      MEASURED IN SERVINGS PER SIX HOURS, ON THE ASSUMPTION THAT A 24-
12900=C      HOUR SCHEDULE IS IN EFFECT. THIS MEANS THAT IF A KITCHEN CAN SERVE
12910=C      600 MEALS PER HOUR, 24 HOURS PER DAY, THEY HAVE AN AVAILABILITY OF
12920=C       $600 \times 6 = 3600$  UNITS PER CYCLE.
12930=C
12940=C      ON THIS BASIS, AN FRN OF 200 PERSONS WILL BE ALLOCATED 200 UNITS
12950=C      OF THAT 3600, AND WILL KEEP THEM UNTIL THEY DEPART THE BILLETING
12960=C      AREA. SHOULD THE MANAGERS WISH TO ESTABLISH A ONE MEAL EVERY 12
12970=C      HOURS, THEY SIMPLY MULTIPLY THE HOURLY CAPABILITY BY 12 INSTEAD OF
12980=C      BY 6.
12990=C
13000=C      THE ALGORITHM USED CONSIDERS EACH OF THE ATRIBUTES (12-16) IN TURN
13010=C      TO SEE IF THE FRN HAS PEOPLE IN THAT AREA. IF SO, IT ATTEMPTS TO
13020=C      ALLOCATE THE FEEDING RESOURCE. IF THERE IS INSUFFICIENT RESOURCE
13030=C      AVAILABLE, THIS WILL NOT PREVENT THE FRN FROM LEAVING ON TIME.
13040=C      THEREFORE, THE ROUTINE MERELY PRINTS AN ADVISORY NOTICE AND ALLOWS
13050=C      THE FRN TO MOVE ON. TO KEEP THE MODEL SIMPLE, NO ATTEMPT IS MADE
13060=C      AT ANY LATER DATE TO ALLOCATE FEEDING WHICH BECOMES AVAILABLE TO
13070=C      THOSE FRNS WHICH DID NOT RECEIVE IT AT THIS POINT.
13080=C
13090=3      CONTINUE
13100=      IF (ATRID(12).GT.0) THEN
13110=          IF (NNRSC(7).GE.ATRID(12)) THEN
13120=              II=ATRID(12)
13130=              ATRID(18)=II
13140=              CALL SEIZE(7,II)
13150=          ELSE IF (NNRSC(7).GT.0) THEN
13160=              II=ATRID(12)-NNRSC(7)
13170=              ATRID(18)=NNRSC(7)
13180=              CALL SEIZE(7,NNRSC(7))
13190=              PRINT$, 'TRABILI POPULATION EXCEEDS FEEDING CAPACITY'
13200=              PRINT$, 'BY ', II, ' PERSONS AT TIME = ', TNOW
13210=          ELSE

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13220=          II=ATRI(12)
13230=          ATRI(18) = 0
13240=          PRINT$, 'TRABIL1 POPULATION EXCEEDS FEEDING CAPACITY'
13250=          PRINT$, 'BY ', II, ' PERSONS AT TIME = ', TNOW
13260=          END IF
13270=          END IF
13280=C
13290=          IF(ATRI(13).GT.0) THEN
13300=              IF(NNRSC(8).GE.ATRI(13))THEN
13310=                  II=ATRI(13)
13320=                  ATRI(18)=II
13330=                  CALL SEIZE(8,II)
13340=              ELSE IF (NNRSC(8).GT.0) THEN
13350=                  II=ATRI(13)-NNRSC(8)
13360=                  ATRI(18)=NNRSC(8)
13370=                  CALL SEIZE(8,NNRSC(8))
13380=                  PRINT$, 'TRABIL2 POPULATION EXCEEDS FEEDING CAPACITY'
13390=                  PRINT$, 'BY ', II, ' PERSONS AT TIME = ', TNOW
13400=              ELSE
13410=                  II=ATRI(13)
13420=                  ATRI(18) = 0
13430=                  PRINT$, 'TRABIL2 POPULATION EXCEEDS FEEDING CAPACITY'
13440=                  PRINT$, 'BY ', II, ' PERSONS AT TIME = ', TNOW
13450=              END IF
13460=          END IF
13470=C
13480=          IF(ATRI(14).GT.0) THEN
13490=              IF(NNRSC(9).GE.ATRI(14))THEN
13500=                  II=ATRI(14)
13510=                  ATRI(18)=II
13520=                  CALL SEIZE(9,II)
13530=              ELSE IF (NNRSC(9).GT.0) THEN
13540=                  II=ATRI(14)-NNRSC(9)
13550=                  ATRI(18)=NNRSC(9)
13560=                  CALL SEIZE(9,NNRSC(9))
13570=                  PRINT$, 'TRABIL3 POPULATION EXCEEDS FEEDING CAPACITY'
13580=                  PRINT$, 'BY ', II, ' PERSONS AT TIME = ', TNOW
13590=              ELSE
13600=                  II=ATRI(14)
13610=                  ATRI(18) = 0
13620=                  PRINT$, 'TRABIL3 POPULATION EXCEEDS FEEDING CAPACITY'
13630=                  PRINT$, 'BY ', II, ' PERSONS AT TIME = ', TNOW
13640=              END IF
13650=          END IF
13660=C

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13670= IF(ATTRIB(15).GT.0) THEN
13680= IF (NRS(10).GE.ATTRIB(15))THEN
13690= II=ATTRIB(15)
13700= ATTRIB(18)=II
13710= CALL SEIZE(10,II)
13720= ELSE IF (NNRSC(10).GT.0) THEN
13730= II=ATTRIB(15)-NNRSC(10)
13740= ATTRIB(18)=NNRSC(10)
13750= CALL SEIZE(10,NNRSC(10))
13760= PRINT*, 'TRABILA POPULATION EXCEEDS FEEDING CAPACITY'
13770= PRINT*, 'BY ', II, ' PERSONS AT TIME = ', TNOW
13780= ELSE
13790= II=ATTRIB(15)
13800= ATTRIB(18) = 0
13810= PRINT*, 'TRABILA POPULATION EXCEEDS FEEDING CAPACITY'
13820= PRINT*, 'BY ', II, ' PERSONS AT TIME = ', TNOW
13830= END IF
13840= END IF
13850=C
13860= IF(ATTRIB(16).GT.0) THEN
13870= IF(NNRSC(11).GE.ATTRIB(16))THEN
13880= II=ATTRIB(16)
13890= ATTRIB(18)=II
13900= CALL SEIZE(11,II)
13910= ELSE IF (NNRSC(11).GT.0) THEN
13920= II=ATTRIB(16)-NNRSC(11)
13930= ATTRIB(18)=NNRSC(11)
13940= CALL SEIZE(11,NNRSC(11))
13950= PRINT*, 'TRABIL5 POPULATION EXCEEDS FEEDING CAPACITY'
13960= PRINT*, 'BY ', II, ' PERSONS AT TIME = ', TNOW
13970= ELSE
13980= II=ATTRIB(16)
13990= ATTRIB(18) = 0
14000= PRINT*, 'TRABIL5 POPULATION EXCEEDS FEEDING CAPACITY'
14010= PRINT*, 'BY ', II, ' PERSONS AT TIME = ', TNOW
14020= END IF
14030= END IF
14040=C
14050= IFLAG=1
14060= RETURN
14070=C

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14080=C#####
14090=C
14100=C      ALLOC(4) ALLOCATES ROOM IN THE PAX STAGING AREA, AND FEEDING (IF
14110=C      AVAILABLE). IF INSUFFICIENT SPACE IS AVAILABLE, THE FRN (WHICH MAY
14120=C      BE ONLY A PART OF AN FRN IF IT WAS DIVIDED AT THE TRANSIENT
14130=C      BILLETING ALLOCATION) IS HELD IN THE QUEUE, AND IS NOT ADMITTED
14140=C      UNTIL ENOUGH SPACE IS AVAILABLE. ONCE ALLOWED IN, THE ROUTINE NEXT
14150=C      ATTEMPTS TO ALLOCATE FEEDING IN A MANNER SIMILAR TO THAT USED IN
14160=C      THE BILLETING AREA. AGAIN, IF THERE IS NOT ENOUGH, A NOTICE IS
14170=C      PRINTED AND THE FRN IS ALLOWED TO PASS.
14180=C
14190=C      THE ROUTINE FIRST IDENTIFIES THE NUMBER OF PERSONS IN THIS GROUP.
14200=C      IF THIS GROUP CAME FROM BILLETING, ONE AND ONLY ONE OF THE FIGURES
14210=C      IN ATRIB(12)-(16) IS NON-ZERO, AND THIS IS THE DESIRED FIGURE. IF
14220=C      THE FRN DID NOT GO THROUGH BILLETING, ATRIB(12)-(16) ARE ALL ZERO,
14230=C      AND THE DESIRED FIGURE IS ATRIB(3). THE APPROPRIATE NUMBER OF
14240=C      SPACES ARE ALLOCATED IF AVAILABLE.
14250=C
14260=C      II=MAX(ATRIB(12),ATRIB(13),ATRIB(14),ATRIB(15),ATRIB(16))
14270=C      IF (II.EQ.0) II=ATRIB(3)
14280=C
14290=C      IF (NNRSC(5).LT.II) THEN
14300=C          IFLAG=0
14310=C          RETURN
14320=C      ELSE
14330=C          CALL SEIZE(5,II)
14340=C          ATRIB(4) = II
14350=C          IF (NNRSC(6).GE.II) THEN
14360=C              CALL SEIZE(6,II)
14370=C              ATRIB(5) = II
14380=C              IFLAG = 1
14390=C              RETURN
14400=C          ELSE IF (NNRSC(6).GT.0) THEN
14410=C              II=II-NNRSC(6)
14420=C              ATRIB(5) = NNRSC(6)
14430=C              CALL SEIZE(6,NNRSC(6))
14440=C              PRINT$, 'PAX STAGING POPULATION EXCEEDS FEEDING'
14450=C              PRINT$, 'CAPABILITY BY ', II, ' PERSONS AT TIME ', TNOW
14460=C              IFLAG=1
14470=C              RETURN
14480=C          ELSE
14490=C              II=ATRIB(4)
14500=C              ATRIB(5) = 0
14510=C              PRINT$, 'PAX STAGING POPULATION EXCEEDS FEEDING'
14520=C              PRINT$, 'CAPABILITY BY ', II, ' PERSONS AT TIME ', TNOW
14530=C              IFLAG=1
14540=C              RETURN
14550=C          END IF
14560=C      END IF
14570=C
14580=C

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14590=C:*****
14600=C
14610=C      ALLOC(5) ALLOCATES SPACE IN THE PASSENGER TERMINAL. EACH UNIT OF
14620=C      THIS RESOURCE REPRESENTS SPACE FOR ONE PERSON. THE FRN WILL BE
14630=C      HELD IN THE QUEUE UNTIL THERE IS SUFFICIENT SPACE FOR THE ENTIRE
14640=C      GROUP IN THE TERMINAL.
14650=C
14660=C      II=MAX(ATRIB(12),ATRIB(13),ATRIB(14),ATRIB(15),ATRIB(16))
14670=C      IF (II.EQ.0) II=ATRIB(3)
14680=C
14690=C      IF (NNRSC(17).LT.II) THEN
14700=C          IFLAG=0
14710=C          RETURN
14720=C      ELSE
14730=C          CALL SEIZE(17,II)
14740=C          ATRIB(4) = II

14750=C          IFLAG=1
14760=C          RETURN
14770=C      END IF
14780=C:*****
14790=C
14800=C      ALLOC(6) ALLOCATES WASHRACKS TO THE VEHICLES, USING THE SAME LOGIC
14810=C      THAT HAS BEEN USED IN SEVERAL OTHER AREAS. THE GROUP OF VEHICLES
14820=C      IS WASHED AND DEPARTS THE WASHRACK AREA AFTER ALL ARE DONE.
14830=C
14840=C      II=ATRIB(17)
14850=C      IF (NNRSC(20).GE.II) THEN
14860=C          ATRIB(17) = 0
14870=C          ATRIB(18) = II
14880=C          CALL SEIZE(20,II)
14890=C          IFLAG = 1
14900=C          RETURN
14910=C      ELSE IF (NNRSC(20).GT.0) THEN
14920=C          ATRIB(17) = ATRIB(17) - NNRSC(20)
14930=C          ATRIB(18) = NNRSC(20)
14940=C          CALL SEIZE(20,NNRSC(20))
14950=C          IFLAG = 1
14960=C          RETURN
14970=C      ELSE
14980=C          IFLAG = 0
14990=C          RETURN
15000=C      END IF
15010=C
15020=C

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15030=C*****
15040=C
15050=C   ALLOC(7) ALLOCATES SLOTS IN THE VEHICLE PROCESSING AREA. EACH SLOT
15060=C   REPRESENTS SPACE FOR ONE VEHICLE TO BE DEFUELED, WEIGHED, AND
15070=C   OTHERWISE MANIPULATED. THE LOGIC USED HERE IS IDENTICAL
15080=C   TO THAT USED IN THE LOGS.
15090=C
15100=C
15110=7   II=ATRIB(17)
15120=   IF (NNRSC(21).GT.0) THEN
15130=       ATRIB(17) =
15140=       ATRIB(17) - II
15150=       CALL SEIZE(21,II)
15160=       IFLAG = 1
15170=       RETURN
15180=   ELSE IF (NNRSC(21).GT.0) THEN
15190=       ATRIB(17) = ATRIB(17) - NNRSC(21)
15200=       ATRIB(18) = NNRSC(21)
15210=       CALL SEIZE(21,NNRSC(21))
15220=       IFLAG = 1
15230=       RETURN
15240=   ELSE
15250=       IFLAG = 0
15260=       RETURN
15270=   END IF
15280=C
15290=C

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15300=C#####
15310=C
15320=C      ALLOC(8) ALLOCATES VEHICLE PARKING SLOTS TO THREE VEHICLES WHICH
15330=C      HAVE COMPLETED PROCESSING BUT ARE NOT YET WANTED IN THE
15340=C      MARSHALLING AREA. IT USES THE LOGIC PREVIOUSLY USED FOR THE
15350=C      FEEDING RESOURCE, WHICH ASSUMES THAT THIS RESOURCE IS NOT REQUIRED
15360=C      FOR A TIMELY DEPARTURE. SHOULD INSUFFICIENT PARKING BE AVAILABLE,
15370=C      A NOTICE IS PRINTED, BUT THE VEHICLE IS NOT FORCED TO WAIT FOR THE
15380=C      PARKING TO BECOME AVAILABLE.
15390=C
15400=C      NOTE THAT ATRIB(17) IS THE NUMBER OF VEHICLES IN THIS GROUP,
15410=C      AND THAT IT IS NOT REDEFINED IN THIS PROCEDURE. THEREFORE, WHEN
15420=C      THE FRN IS RELEASED, ATRIB(17) IS THE NUMBER OF VEHICLES AND
15430=C      ATRIB(18) IS THE NUMBER OF PARKING SPOTS THEY WERE GIVEN.
15440=C
15450=8      II=ATRIB(17)
15460=      IF(NNRSC(22).GE.II) THEN
15470=          ATRIB(18) = II
15480=          CALL SEIZE(22,II)
15490=          IFLAG = 1
15500=          RETURN
15510=      ELSE IF (NNRSC(22).GT.0) THEN
15520=          ATRIB(18) = NNRSC(22)
15530=          II = ATRIB(17) - NNRSC(22)
15540=          CALL SEIZE(22,NNRSC(22))
15550=          PRINT*, 'VEHICLE PARKING OVERFLOW BY ', II
15560=          PRINT*, 'UNITS AT TIME = ', TNOW
15570=          IFLAG = 1
15580=          RETURN
15590=      ELSE
15600=          ATRIB(18) = 0
15610=          PRINT*, 'VEHICLE PARKING OVERFLOW BY ', II
15620=          PRINT*, 'UNITS AT TIME = ', TNOW
15630=          IFLAG = 1
15640=          RETURN
15650=      END IF
15660=C

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15670=C*****
15680=C
15690=C  ALLOC(9) ALLOCATES THE JOINT INSPECTION (JI) TEAMS TO INSPECT THE
15700=C  VEHICLES AND PALLETS. AS EACH GROUP ARRIVES, ATRIB(17) IS THE
15710=C  NUMBER OF VEHICLES OR PALLETS TO BE INSPECTED. AS INSPECTORS ARE
15720=C  ALLOCATED, ATRIB(17) IS DECREMENTED AND ATRIB(18) IS INCREMENTED
15730=C  TO SHOW THE CURRENT NUMBER OF INSPECTORS THAT THE GROUP HAS.
15740=C
15750=C  ALLOC(9) ALSO SELECTS THE NUMBER OF FAILURES THAT THIS GROUP WILL
15760=C  HAVE, BASED ON XX(60), THE USER'S ESTIMATE OF FAILURE PROBABILITY.
15770=C  THE NUMBER OF FAILURES IN EACH GROUP IS PLACED IN ATRIB(3), AND
15780=C  THE NUMBER OF PASSES IS PLACED IN ATRIB(4). THEY ARE SORTED OUT
15790=C  LATER IN THE NETWORK.
15800=C
15810=9  II=ATRIB(17)
15820=  IF(NNRSC(23).EQ.0) THEN
15830=    IFLAG = 0
15840=    RETURN
15850=  ELSE IF (NNRSC(23).LT.II) THEN
15860=    ATRIB(17) = ATRIB(17) - NNRSC(23)
15870=    ATRIB(18) = NNRSC(23)
15880=    CALL SEIZE(23,NNRSC(23))
15890=  ELSE IF (NNRSC(23).GE.II) THEN
15900=    ATRIB(17) = 0
15910=    ATRIB(18) = II
15920=    CALL SEIZE(23,II)
15930=  END IF
15940=  J = ATRIB(18)
15950=  DO 30 I=1,J
15960=    XX(98) = DRAND(6)
15970=    IF(XX(98).LT.XX(60)) ATRIB(3) = ATRIB(3) + 1
15980=    IF(XX(98).GE.XX(60)) ATRIB(4) = ATRIB(4) + 1
15990=30  CONTINUE
16000=  IFLAG = 1
16010=  RETURN
16020=C
16030=C*****
16040=C
16050=C  ALLOC(10) ALLOCATES THE UNIT ASSEMBLY AREA(S) TO OFF-BASE URC. THE
16060=C  LOGIC IS SIMILAR TO THAT USED IN ALLOCATING THE TRANSIENT
16070=C  BILLETING AREAS. THERE MAY BE UP TO FIVE UNIT ASSEMBLY AREAS,
16080=C  DESIGNATED UASAREA1 TO UASAREA5 IN ORDER OF PREFERENCE (IN MOST
16090=C  CASES UASAREA1 WOULD BE THE CLOSEST, WITH THE OTHERS FURTHER AWAY)
16100=C

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16110=C      AS IN ALLOC(1), THE ALGORITHM FIRST ATTEMPTS TO PUT THE ENTIRE FRN
16120=C      INTO A SINGLE AREA. FAILING THAT, IT NEXT LOOKS FOR THE LARGEST
16130=C      AVAILABLE CHUNK OF AREA AND ALLOCATES THAT TO THE FRN, FOLLOWED
16140=C      BY THE NEXT LARGEST, AND SO ON UNTIL NO MORE UASAREA IS AVAILABLE.
16150=C      UNLIKE ALLOC(1), HOWEVER, THIS ALGORITHM WILL ALLOCATE AS MUCH AS
16160=C      IT CAN TO THE FRN UPON ARRIVAL. RECALL THAT ALLOC(1) WOULD HOLD
16170=C      THE FRN IN A QUEUE IF THERE WASN'T ENOUGH BILLETING TO BILLET THE
16180=C      ENTIRE GROUP. ALLOC(10) ASSUMES THAT EVEN IF THERE ISN'T ENOUGH
16190=C      UASAREA TO HOLD ALL THE CARGO, SOME CAN BE ADMITTED TO BEGIN
16200=C      PROCESSING. THE REMAINDER IS HELD IN A QUEUE. NOTE THAT THIS WILL
16210=C      RESULT IN THE ORIGINAL ENTITY BEING SPLIT INTO SEVERAL PARTS.
16220=C      THEREFORE, FOLLOWING THIS STEP ATRIBUTES 4-9 (THE TONNAGE FIGURES
16230=C      FOR THE ORIGINAL ENTITY) ARE NOT MEANINGFUL, AND MAY BE FREELY
16240=C      REASSIGNED TO OTHER PURPOSES.
16250=C
16260=10      II=ATRIB(17)
16270=        DO 50 J=25,29
16280=          IF(NNRSC(J).GE.II) THEN
16290=            NBR = J-13
16300=            ATRIB(17) = 0
16310=            ATRIB(NBR) = II
16320=            CALL SEIZE(J,II)
16330=            IFLAG = 1
16340=            RETURN
16350=          END IF
16360=50      CONTINUE
16370=C
16380=        NNEED = ATRIB(17)
16390=75      II = MAX(NNRSC(25),NNRSC(26),NNRSC(27),NNRSC(28),NNRSC(29))
16400=        IF (II.EQ.0) THEN
16410=          IFLAG = 0
16420=          RETURN
16430=        END IF
16440=        LJ 60 K = 25,29
16450=        NBR = K-13
16460=          IF(II.EQ.NNRSC(K)) THEN
16470=            IF(II.LT.NNEED) THEN
16480=              ATRIB(17) = NNEED - II
16490=              NNEED = NNEED - II
16500=              ATRIB(NBR) = II
16510=              CALL SEIZE(K,II)
16520=            ELSE IF (II.GE.NNEED) THEN
16530=              ATRIB(17) = 0
16540=              ATRIB(NBR) = NNEED
16550=              CALL SEIZE(K,NNEED)
16560=              IFLAG = 1
16570=              RETURN
16580=            END IF
16590=          END IF
16600=60      CONTINUE
16610=        GO TO 75
16620=C

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16630=C*****
16640=C
16650=C      ALLOC(11) ALLOCATES PALLET TRANSPORTATION FROM THE ASSEMBLY AREAS
16660=C      TO THE J1 AREA. THIS RESOURCE IS ASSUMED TO BE A 40-FOOT FLATEED,
16670=C      CAPABLE OF CARRYING 4 PALLETS. THE ALGORITHM USES ATRIB(17), THE
16680=C      NUMBER OF PALLETS IN THIS GROUP, AS THE BASIS FOR ALLOCATION. IN
16690=C      ORDER FOR ANY ALLOCATION TO TAKE PLACE, THERE MUST BE AT LEAST ONE
16700=C      FLATBED AND ONE UASAREA FORKLIFT AVAILABLE. IF THERE IS, EITHER
16710=C      FOUR PALLETS OR ALL OF THEM (WHICHEVER IS LESS) ARE LOADED. ATRIB
16720=C      (17) IS DECREMENTED BY THAT NUMBER, AND THE FRN IS RELEASED. IF
16730=C      ATRIB(17) IS GREATER THAN 0, INDICATING THAT MORE PALLETS NEED
16740=C      TRANSPORTATION, A DUPLICATE ENTITY WILL LOOP BACK FOR FURTHER
16750=C      ALLOCATION. THE ENTITY REPRESENTING THE PALLETS THAT DID RECEIVE
16760=C      TRANSPORT WILL CONTINUE THROUGH THE NETWORK. THEREFORE, FROM THIS
16770=C      POINT ON, THE LARGEST GROUP OF PALLETS SHOULD HAVE NO MORE THAN
16780=C      FOUR PALLETS.
16790=C
16800=C      FOR SIMPLICITY'S SAKE, THE ONBASE URC PALLETS ARE FED THROUGH THIS
16810=C      ROUTINE ALSO, THOUGH THEY WILL COME FROM DIFFERENT AREAS OF THE
16820=C      BASE.
16830=C
16840=11      II=ATRIB(17)
16850=      IF (NNRSC(30).GE.1.AND.NNRSC(32).GE.1) THEN
16860=          ATRIB(18) = MIN(4,II)
16870=C          ATRIB(18) SHOWS HOW MANY PALLETS ARE ON THIS LOAD
16880=          ATRIB(17) = ATRIB(17) - ATRIB(18)
16890=C          ATRIB(17) SHOWS HOW MANY ARE LEFT
16900=          CALL SEIZE(30,1)
16910=          CALL SEIZE(32,1)
16920=          IFLAG=1
16930=          RETURN
16940=      ELSE
16950=          IFLAG=0
16960=          RETURN
16970=      END IF
16980=C
16990=C*****
17000=C
17010=C      ALLOC(12) ALLOCATES THE FRUSTRATED CARGO PROCESSING AREA. ON THE
17020=C      ASSUMPTION THAT EVEN IF SPACE RUNS OUT, THE PALLETS CAN BE DUMPED
17030=C      SOMEWHERE AND FIXED, THE ALGORITHM TREATS THE RESOURCE AS NON-
17040=C      REQUIRED FOR TIMELY DEPARTURE (SIMILAR TO FEEDING). WHEN THE
17050=C      SPACE RUNS OUT, A NOTICE IS PRINTED AND THE FRN IS ALLOWED TO
17060=C      PROCEED. ATRIB(17) IS THE NUMBER OF PALLETS IN THE GROUP, AND
17070=C      ATRIB(18) IS THE NUMBER OF SPACES THEY RECEIVED.
17080=C

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17090=12  II=ATRI(17)
17100=    IF (NNRSC(31).EQ.0) THEN
17110=        PRINT*, 'FRUSTRATED PALLET AREA OVERFLOW BY ', II
17120=        PRINT*, 'PALLETS AT TIME = ', TNOW
17130=        IFLAG = 1
17140=        RETURN
17150=    ELSE IF (NNRSC(31).LT.11) THEN
17160=        ATRI(18) = NNRSC(31)
17170=        II = II-ATRI(18)
17180=        CALL SEIZE(31,NNRSC(31))
17190=        PRINT*, 'FRUSTRATED PALLET AREA OVERFLOW BY ', II
17200=        PRINT*, 'PALLETS AT TIME = ', TNOW
17210=        IFLAG = 1
17220=        RETURN
17230=    ELSE
17240=        ATRI(18) = II
17250=        CALL SEIZE(31,II)
17260=        IFLAG = 1
17270=        RETURN
17280=    END IF
17290=C
17300=C*****
17310=C
17320=C  ALLOC(13) ALLOCATES THE J1 FORKLIFT TO MOVE PALLETS AROUND THE
17330=C  AREA. THIS INCLUDES UNLOADING THE FLATBED, MOVING INTO INSPECTION,
17340=C  MOVING TO AND FROM THE FRUSTRATED PALLET AREA, AND MOVING INTO THE
17350=C  MARSHALLING YARD.
17360=C
17370=13  II=ATRI(17)
17380=    IF (NNRSC(33).EQ.0) THEN
17390=        IFLAG = 0
17400=        RETURN
17410=    ELSE IF (NNRSC(33).LT.11) THEN
17420=        ATRI(17) = ATRI(17) - NNRSC(33)
17430=        ATRI(18) = NNRSC(33)
17440=        CALL SEIZE(33,NNRSC(33))
17450=        IFLAG = 1
17460=        RETURN
17470=    ELSE
17480=        ATRI(17) = 0
17490=        ATRI(18) = II
17500=        CALL SEIZE(33,II)
17510=        IFLAG = 1
17520=        RETURN
17530=    END IF
17540=C

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17550=C:*****
17560=C
17570=C      ALLOC(14) ALLOCATES SPACE IN THE MARSHALLING AREA. PRIOR TO THIS,
17580=C      ATRIB(17) WAS REDEFINED AS THE SHORT TONS OF VEHICLES OR PALLETS
17590=C      IN THIS GROUP. RESOURCE 24 IS DEFINED AS CAPACITY IN SHORT TONS.
17600=C      HERE AGAIN IT IS ASSUMED THAT AN OVERFLOW OF THE ALLOTTED AREA
17610=C      WILL NOT PREVENT TIMELY DEPARTURES, SO IN SUCH A CASE A MESSAGE IS
17620=C      PRINTED AND THE FRN IS ALLOWED TO CONTINUE.
17630=C
17640=14      II=NINT(ATRIB(17))
17650=      IF (NNRSC(24).EQ.0) THEN
17660=      ATRIB(18) = 0
17670=          PRINT*, 'MARSHALLING YARD OVERFLOW BY ', II
17680=          PRINT*, 'SHORT TONS OF CARGO AT TIME = ', TNOW
17690=          IFLAG = 1
17700=          RETURN
17710=      ELSE IF (NNRSC(24).LT.II) THEN
17720=          II = II - NNRSC(24)
17730=          ATRIB(18) = NNRSC(24)
17740=          CALL SEIZE(24,NNRSC(24))
17750=          PRINT*, 'MARSHALLING YARD OVERFLOW BY ', II
17760=          PRINT*, 'SHORT TONS OF CARGO AT TIME = ', TNOW
17770=          IFLAG = 1
17780=          RETURN
17790=      ELSE
17800=          ATRIB(18) = II
17810=          CALL SEIZE(24,II)
17820=          IFLAG = 1
17830=          RETURN
17840=      END IF
17850=C
17860=C
17870=C:*****
17880=C
17890=C      ALLOC(15) ALLOCATES NRC TERMINAL SPACE. THIS SPACE, LIKE THE
17900=C      MARSHALLING AREA, IS MEASURED BY TONNAGE CAPACITY. IT IS
17910=C      LIKewise ASSUMED THAT AN OVERFLOW OF THIS AREA WILL NOT PREVENT
17920=C      THE CARGO FROM BEING PROCESSED, SO IN SUCH CASES A MESSAGE IS
17930=C      PRINTED AND THE CARGO IS PERMITTED TO PROCEED.
17940=C

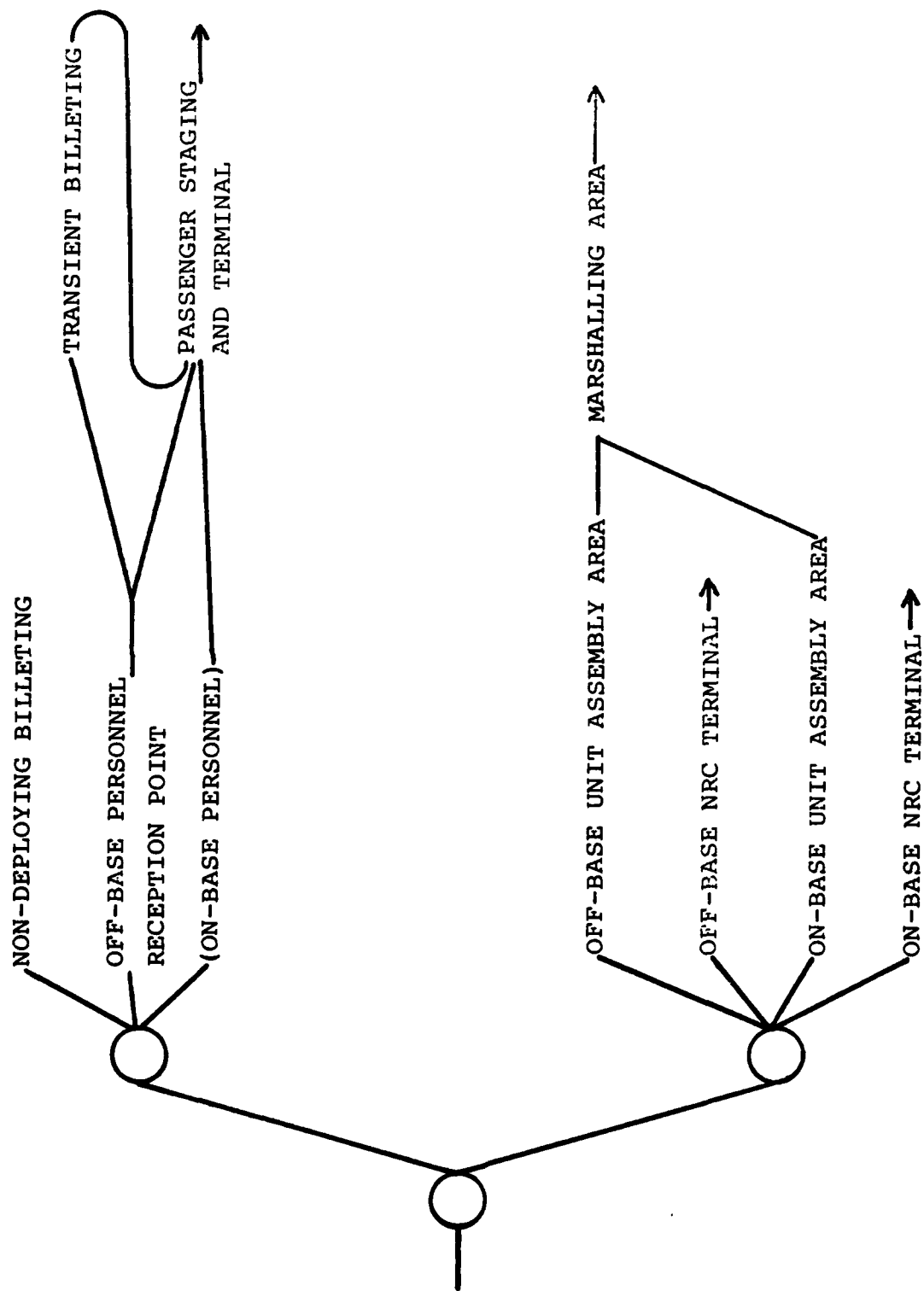
```

```

17950=15      II=NINT(ATTRIB(4))
17960=        IF (NNRSC(36).EQ.0) THEN
17970=          PRINT*, 'NRC TERMINAL OVERFLOW BY ', II
17980=          PRINT*, 'SHORT TONS OF CARGO AT TIME = ', TNOW
17990=          IFLAG = 1
18000=          STOP
18010=        ELSE IF (ATTRIB(4).LT.II) THEN
18020=          II = II - NNRSC(36)
18030=          ATTRIB(16) = NNRSC(36)
18040=          CALL SEIZE(36,NNRSC(36))
18050=          PRINT*, 'NRC TERMINAL OVERFLOW BY ', II
18060=          PRINT*, 'SHORT TONS OF CARGO AT TIME = ', TNOW
18070=          IFLAG = 1
18080=          RETURN
18090=        ELSE
18100=          ATTRIB(18) = II
18110=          CALL SEIZE(36,II)
18120=          IFLAG = 1
18130=          RETURN
18140=        END IF
18150=C
18160=*****
18170=C
18180=C      ALLOC(16) ALLOCATES NRC TERMINAL FORKLIFTS TO UNLOAD INCOMING
18190=C      CARGO. THIS CARGO MAY ARRIVE IN ANY FORM, ON STANDARD WOOD
18200=C      PALLETS, 463L PALLETS, OR NO PALLETS AT ALL. FOR SIMPLICITY'S
18210=C      SAKE, THIS ALGORITHM ASSUMES THAT ALL INCOMING CARGO WILL BE
18220=C      PALLETIZED (ALTHOUGH THE TYPE OF PALLET IS OF NO CONCERN HERE).
18230=C      IT FURTHER ASSUMES THAT EACH PALLET WEIGHS 1.5 TONS, AND THAT
18240=C      EVERY AVAILABLE FORKLIFT WILL BE PUT TO WORK UNTIL THE JOB IS
18250=C      COMPLETED.
18260=C
18270=16      IF(NNRSC(37).EQ.0) THEN
18280=          IFLAG=0
18290=          RETURN
18300=        ELSE IF(NNRSC(37).GT.0) THEN
18310=          CALL SEIZE(37,1)
18320=          ATTRIB(4) = ATTRIB(4) - 1.5
18330=          IF (ATTRIB(4).LT.0) ATTRIB(4) = 0
18340=          IFLAG = 1
18350=          RETURN
18360=        END IF
18370=C
18380=C*****
18390=C
18400=        END
18410=1EOR

```

APPENDIX E
FLOW SCHEMATIC FOR THE PHASE I MODEL



APPENDIX F
USER'S GUIDE

This user's guide will provide a concise step-by-step procedure for operation of each model. It assumes that the user is trained in the use of SLAM II and FORTRAN. It further assumes that the user has an account with the ASD computer center and is familiar with the NOS/BE operating system used on the ASD Cyber computer at Wright-Patterson AFB. This guide is written for that system. While the model can be used on any other system containing the SLAM software, the parts of this guide which are system specific will need to be modified.

The final assumption is that the users have established the legal right to access the SLAM software on the ASD computer. AFIT personnel have indicated that it was purchased at the "educational institution" price, which precludes commercial use. This issue should be resolved through the contracting office before any non-AFIT use of this model is attempted.

SECURITY CONSIDERATIONS

Since all TPFDD data used in this model will be classified, real-world operation of the model must be in the classified mode. At ASD, this is accomplished at night. The computer is disconnected from all remote terminals, as well as most output devices. As a result, the SLAM software is not readily accessible. It must be written to a tape, which is mounted by the operator when the job is run.

In addition to the SLAM software, a PROCFIL must be included on that tape. The user may use any number of methods to do this. The following was used in this thesis, and is presented as an example. The character '*' before a line indicates a command to be entered as written here. Lower case names in such commands are assigned by the user.

- (1) Login on any remote terminal.
- (2) * ATTACH,PROCFIL,ID=A810171,SN=ASDAD
- (3) * BEGIN,NOSFILE
- (4) * BUILD,file name (this creates a permanent file in which the user's files may be stored.)
- (5) Get into the EDITOR routine, and create the following file:

```

100=.PROC,SLAMII,N=0,I=INPUT,L=OUTPUT,MAP=OFF,PMD=0,
110=PL=5000,VER=115,REL=NEW.
120=IFE,NUM(PMD).EQ.0,NOPMD.
130=IFE,NUM(M).EQ.1,MERGE.
140=#MAP,MAP.
150=LOAD,XXISLAM.
160=EXECUTE,,I,L,,,#PL=PL.
170=ELSE,MERGE.
180=#MAP,MAP.
190=REWIND,M.
200=LOAD,M.
210=LOAD,XXISLAM.
220=EXECUTE,,I,L,,,#PL=PL.
230=ENDIF,MERGE.
240=ELSE,NOPMD.
250=IFE,NUM(M).EQ.1,MERGE.
260=#MAP,MAP.
270=SEGLOAD,#I=SLANSEG.
280=LOAD,XXISLAM.
290=EXECUTE,,I,L,,,#PL=PL.
300=ELSE,MERGE.
310=#MAP,MAP.
320=SEGLOAD,#I=SLANSEG.
330=LOAD,M.
340=LOAD,XXISLAM.
350=EXECUTE,,I,L,,,#PL=PL.
360=ENDIF,MERGE.
370=ENDIF,NOPMD.
380=.DATA,SLANSEG.
390=      TREE MAIN-(DDATN,GGASP)

```



```

400=MAIN  INCLUDE SLAM,DDUMP,FFILE,PRNTE,SET
410=DDATN INCLUDE BBLD,CCODE,CCODX,DDFLT,DDTNM,ERRIN,RRSLV,SELPL
420=GGASP INCLUDE AARVT,ALLOC,ALTER,BETA,CAVG,CCHX,CCMIN,CCNUM,
430=,CCSTD,CLEAR,
440=,CLOX,COLCT,COPAA,COPY,DKRSS,DPROB,DRAND,ENTER,ERLNG,ERROR,
450=,EVENT,EXPON,FDUMP,
460=,FFAVG,FFAWT,FFMAX,FFPRD,FFSTD,FFTLC,FILEN,FREE,
470=,GAM,GAMA,GDLAY,GETAA,GGPLT,
480=,GPLOT,GTABL,HHSTD,IINLZ,INTLC,INTRN,KXRSS,LINK,LOCAT,MMFE,MMLE,
490=,MONTR,NFIND,NNACT,NNBK,NNCNT,NNGAT,NNG,NRSC,
500=,NPRED,NPSSN,NQS,NSS,NSUCR,OPEN,
510=,QPUT,PRNTA,PRNTC,PRNTG,PRNTH,PRNTP,PRNTR,PRNTE,PRNTT,
520=,PRODB,PUTAA,RLOGN,
530=,RMOVE,RNORM,RAVG,RREL,RMAX,RRPRD,RRSTD,RRTLC,
540=,SAVPL,SCHDL,SEIZE,SETAA,SSACT,
550=,SSAVE,SSCND,SSELQ,SSEVT,STATE,STOPA,
560=,SUMPL,SUMQ,SUMRY,TRIAG,TTAVG,TTMAX,
570=,TTMIN,TTMSA,TTMST,TTPRD,TTSTD,TTTLC,
580=,UBLK,UERR,ULINK,UMONT,UNFRM,USERF,
590=,VVAR,VVARX,WEIBL,XRN,XXERR
600=      COMMON
610=      END
620=TEOR

```

- (6) * SAVE,lfn,N,O
- (7) * REPLACE,lfn,ID=file name

At this point, the user has the SLAM PROCFIL in the permanent file set up by the BUILD command. This file, along with SLAM, must now be written to tape. The following procedure may be used.

- (1) Obtain a tape number from the ASD computer center.
- (2) Submit the following job. This thesis used cards for the input, because a tape transaction request must be submitted as well.

```

*   jobcard
*   REQUEST,INTAPE,GE,RING,VSN=tapenumber.
*   ATTACH PROCFIL,ID=A810171,SN=ASDAD.
*   BEGIN,NOSFILE.
*   GET,lfn,ID=file name. (this retrieves the
PROCFILE saved as 'lfn' in the user's permanent file 'file
name')
*   ATTACH,SLAMII5,ID=AFIT,CY=1.
*   COPYBF,lfn,INTAPE.
*   COPYBF,SLAMII5,INTAPE.
*   end of job card

```

At this point, the tape is available for classified processing. The following cards must be included in the front part of the simulation card deck when it is submitted.

- * job card
- * REQUEST,INTAPE,GE,NORING,VSN=tape number.
- * COPYBF,INTAPE,lfn.
- * COPYBF,INTAPE,XXXSLAM.
- * REWIND,XXXSLAM.
- * RETURN,INTAPE.
- * FTN5(LO=0,ANSI=0).
- * BEGIN,SLAMII,lfn,M=LGO.
- * 7/8/9 overpunch

Note that the two files on the tape must be read in the same order in which they were written. Also note that the name of the user-created PROCFIL must be specified in the BEGIN,SLAMII card. The FTN5 card compiles the user-written subroutines which immediately follow these cards. An additional card should be included to route the output to be printed on paper marked with the appropriate security markings. (Consult the ASD computer center.) Additional REQUEST cards must be included if the source data is on tape. As a final note, the user must insure that the person who submits the job has a letter on file at the computer center authorizing him or her to pick up classified output.

PREPARATION AND OPERATION OF PHASE I

The following list of steps is a summary of information appearing in Chapters 3 and 5.

- (1) Obtain the most current TPFDD data for the plan and APOE of interest.

(2) Obtain the other input data from the Reserve Personnel office. Insure that the format matches the data fields to be used from the TPFDD tape (either the EAD/LAD or ALD/EDD, depending on the refinement level of the TPFDD).

(3) In the Phase I model, insure that EVENT(1) is set up to read the format of the data being used. If there is reason to believe that there are more than 1000 FRNs from all sources, use the modified routine discussed in Chapter 4 for EVENTS (1) and (2).

(4) Set all XX(.) variables to the appropriate values.

(5) Set the RECORD and VAR statements to produce output in the desired form.

(6) Insure that the LIMITS card will allow the expected number of entities into the network.

(7) Set the INIT card to the desired length of the simulation. Recall that time is expressed in hours.

(8) Insure that all card sequences, end of record cards, and end of job cards are proper.

(9) Submit the job to the staging desk at the ASD computer center.

PREPARATION AND OPERATION OF PHASE II

The procedures above apply to Phase II as well. There is, however, considerably more work involved due to the greater complexity of the model, the large number of

XX(.) variables and user-written subroutines which must be validated, the provisions for policy options which must be exercised, and the resource levels which must be quantified. Additionally, the Phase II model will be used for experimentation, which involves multiple runs. It is recommended that the user consult any of the books on experimental design which are available in setting up the form of the experiment.

If the user wishes to examine the system's operation for a specific period (say from midnight of day 5 to noon of day 10), the following steps should be accomplished in addition to those above.

- (1) Add the following card after the INIT card:

MONTR,CLEAR,120.0;

This will clear the statistical arrays after 120 hours (5 days) of simulated time.

- (2) Modify the INIT card to read:

INIT,0,228.0;

This will terminate the run at noon of day 10 (228 hours).

In this manner, the managers may focus their attention on the days of peak workloads, with the statistics unbiased by the initial days of activity (or inactivity). This may also be used in the Phase III application to examine only those next few days for which the flow plan is prepared.

CARD DECK ARRANGEMENT

For either of the models, the following sequence applies:

- jobcard
- control cards (discussed in Security Considerations)
 - 7/8/9 overpunch card
- subroutines
 - 7/8/9 overpunch card
- SLAM network statements (GEN through FIN)
- input data (if on cards)
 - 6/7/8/9 overpunch "End of Job" card

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